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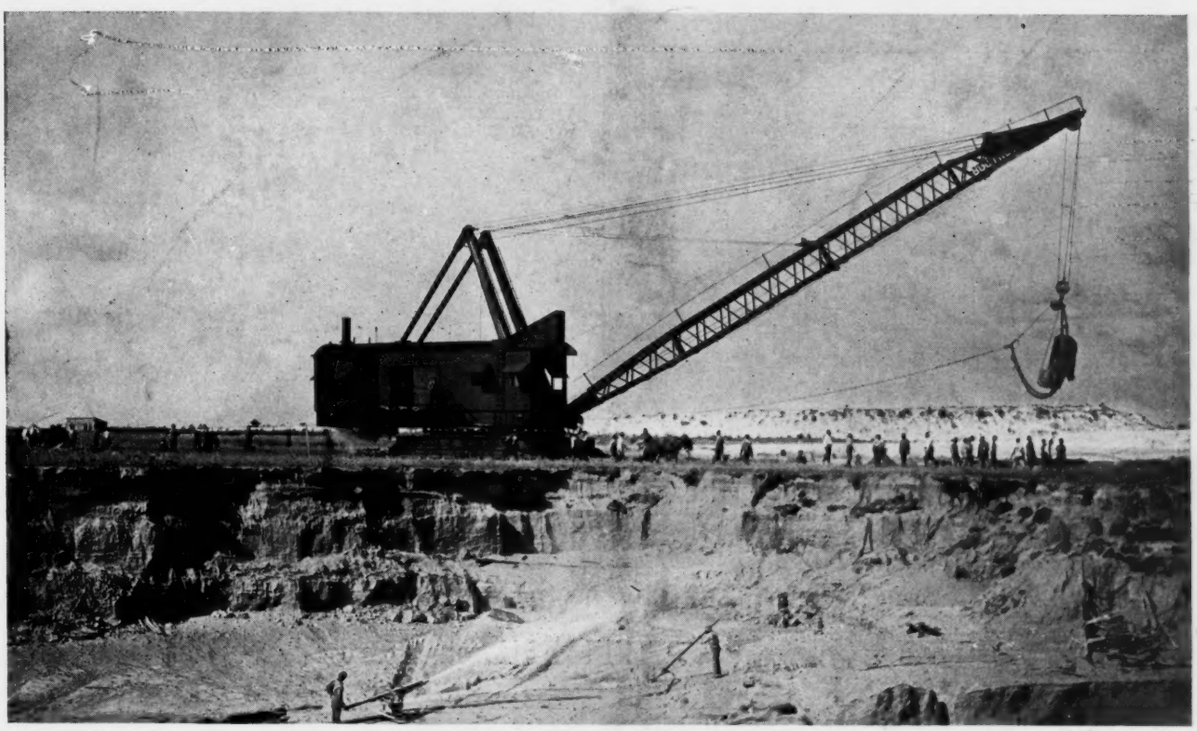

Open Pit Mining of Hard Rock Phosphate in Florida

Dredge Construction at Dayton, Nevada

By George J. Young

Phosphate Mining in Florida

By Strauss L. Lloyd

Small Scale Mining and Smelting in Chile

By Walter Strache

Biography of Frederick Leslie Ransome

The Boswell gold mine, in southwestern Oregon, described by Henry M. Parks in Mining News in this issue, is attracting much attention. A bonanza on surface, it promises to continue at depth, unlike other Oregon properties, which are usually shallow.

Do you know that Germany is the heaviest purchaser of American copper, and that Germany, despite her financial difficulties, is paying cash, whereas other countries are receiving liberal credits from the Copper Export Association? See page 118.

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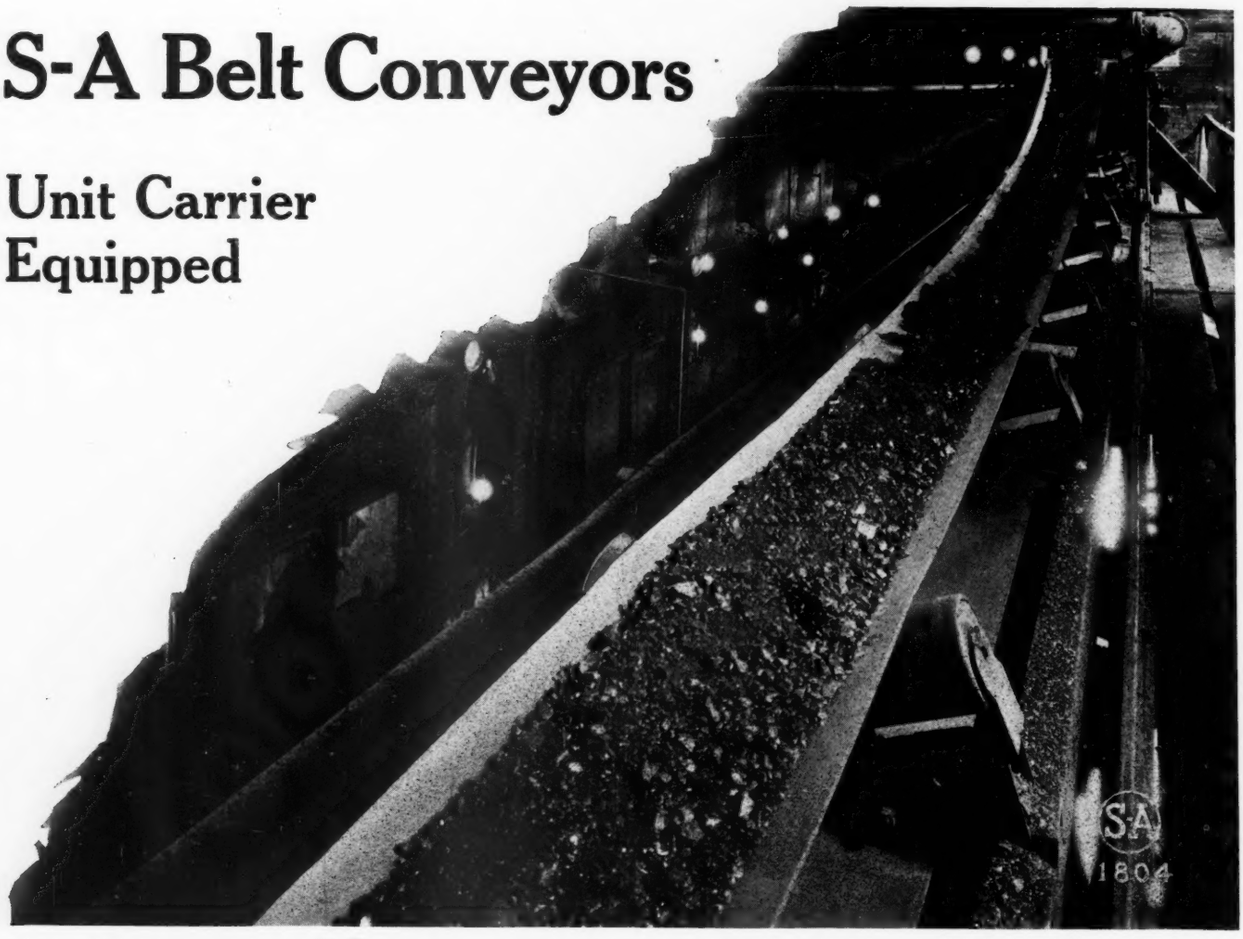

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Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

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W. N. P. REED
CLEVELAND ABBE, Jr., Assistant Editors
BENJAMIN L. MILLER
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Volume 112 New York, July 16, 1921 *Number* 3

Employee Representation at Bisbee

ORGANIZING A PLANT with the Federal Government as a model, a scheme often associated with the name of John Leitch, has generally been successful in promoting efficiency and in decreasing labor troubles wherever tried. A notable example is that of the Goodyear Tire & Rubber Co. The secret, an open one, lies in employee representation without paternalism.

The plan is to be further tried at Bisbee, Ariz., where on June 28, as told in our news columns last week, the employees of the Phelps Dodge Corporation adopted the constitution of an "employees' representation plan," by a vote of 907 out of 923 who were eligible to vote. The Phelps Dodge Corporation is the first large mining company to take this important step.

Under their new constitution the employees will have a voice in the adoption of rules and regulations governing their work and conditions of employment through their own representatives. Certain broad powers are guaranteed to them, those not specified being reserved to the company. In particular it is stipulated that the company has the unquestionable right to increase or decrease production or the scale of its operations as it chooses. The executive power is vested in the president and the general manager in charge of the company's routine business.

It will be interesting to watch the results of the experiment at Bisbee, where, in spite of the general curtailment, the time is considered opportune to try out the plan. The relations of the Phelps Dodge Corporation with its employees have always been peculiarly happy. As a correspondent writes us, "If other large companies looked at their relations with their men in the same light as the Phelps Dodge does, there would be much less unrest and labor difficulties."

The Tariff on Minerals and Metals

THE TARIFF QUESTION is the affair of greatest interest in Congress at the present time. Business is depressed: and according to the accepted popular formula, it is the fault of the Government. A new Administration has come into office; and accepting the theory that the depression has been due to the last Administration, it proceeds first to prepare and administer the approved remedy of the party for business troubles —increased tariff duties, to be taken frequently in large doses until recovery, and to be taken thereafter as a preventive.

The present proposed tariff "protects" a lot of industries. Any American industry is open to "protection" under this theory, so long as it applies in due form. So among the metal industries we have duties on manganese, molybdenum, tungsten, aluminum, antimony, quicksilver, tin, lead, and zinc. These will protect various American industries. The tariff on aluminum will subsidize the Aluminum Company of America, which will be practically the sole beneficiary; the tariff on tin in bars will subsidize the few tin smelters hereabouts, which will be the sole beneficiaries; and so on. In the case of tin ore, of course, there could be no duty, for we have no tin mines, and the tin-smelting industry of the United States runs exclusively on imported ores.

Every man, woman, and child in the United States uses and pays for tin and aluminum; and it is a question we are not prepared to solve whether each should or should not be taxed for the protection of closely controlled or monopolistic industries. Personally, and on selfish grounds only, we object to this tax; but there are doubtless millions who are eager to pay it.

The import tax of five cents a pound on nickel is not of interest to the mining industry. We do not mine nickel in the United States. It is a tax to protect the nickel-smelting industry, which centers around New York, and which operates exclusively on imported ores; and the tax is designed to enable these to survive principally the competition of nickel shipped from Europe as well as a new Canadian refinery.

Mining men, running over the list of metals protected, are likely to think that something is being done to help the mining industries. This is so in some cases—manganese ore, molybdenum ore, tungsten ore, lead and zinc ores are subject to an import tariff. Of molybdenum ore we have a large quantity: the tariff will principally benefit one company, the American Metal Company, which is probably able to supply the country's needs from its properties at Climax. Manganese and tungsten fall into the group of which we have a limited supply: therefore, conservationists have argued against the exhaustion of these deposits being artificially stimulated. The reply to this argument is, "Nonsense; we have unlimited supplies of manganese and tungsten in this country."

Without debating this question at present, we should like to have seen a duty on tin ore and nickel ore, on this same theory, for these cases are to the point. If geologists and engineers are talking nonsense about manganese and tungsten, why are they not talking nonsense about nickel and tin? We shall not fail to find indignant subscribers who will object to our saying we have no nickel or tin in this country, so we should like to have seen it tried, because you cannot spoil a rotten egg; and under the stimulus of a high tariff we should like to watch the tin and nickel mining industries expand. But you can spoil a good egg—you can gut and wreck deposits of ores of which we have a limited supply; and the Geological Survey assures us this is the case with high-grade manganese ores and with tungsten ores.

There was a time when Maryland was the world's greatest producer of chromite. Now the chromite is gone, and the mining period is scarcely a memory. As

regards the tariff on chromium, we note that there is no tariff on chromium ore, but there is one on the ferro-alloy, ferrochromium. This means that the tariff will not benefit the American chrome-mining industry, but will make the Electrometallurgical Company the sole beneficiary. This company has a practical monopoly on the ferrochromium industry, is probably the largest manufacturer of ferrochromium in the world, and uses imported ores. We are not criticising this arrangement: we are merely elucidating the tariff. Chromite certainly belongs in that group, like tungsten and manganese—only perhaps more so—of which we have only a limited supply of our own. Among other raw material products protected are: Graphite, mica, talc, bauxite, fluorspar, asphalt, fuller's earth, clays, pumice, gypsum, limestone, and building stones. Refractory brick, including magnesite and chromite brick, are also covered by substantial tariffs.

Meeting Business Half Way

WE HAVE for some time given voice to our opinions regarding the situation in the mining industry. We have attempted to point out that the depression through which we have been passing is but the natural outcome of events and not a condition which gives any deep-seated reason for alarm. We have offered suggestions, from time to time, as to ways and means that might bring about a speedier rehabilitation in mining, in the meantime looking hopefully for those signs that would indicate that the curve had ceased to drop and was on the upward trend. Certain indications belie the fact that there is any decided change in the situation. Metal prices are still at a low figure, there seems to be little or no market, and reports of the resumption of operations at plants recently shut down are slow in coming in. On the other hand we hear of certain improvements in various sections of the country, and these must have their reflections on the mining industry. We refer particularly to a gradual picking up of the buying market for machinery which has undoubtedly been influenced by a decrease in price.

Considering the mining business from its mechanical side—that is, that part of the work which requires equipment—we can regard the items of new construction and replacement as essential to the successful continuation of any mining enterprise. New construction is, speaking generally, more typically characteristic of good times, of a period when industry is at its top notch, and when a demand for big production necessitates capacity output. Replacement necessarily exists at the same time as the "new construction" period; but, on the other hand, it remains during the slack time and is continuous, or should be. It serves as the auxiliary, as it were, to the other, regardless of whether business is good or dull.

The idea of putting off until tomorrow what one cannot do today has been the graveyard of many businesses as well as individuals. Business does not continuously play a waiting game, for the modern trend is toward large production and lower costs, and those who cannot compete on those conditions are out of the running.

Replacement, as we have used the term, does not mean simply keeping all the parts of the mine, mill, and smelter in good order, so that on the return of business operations may resume as before. It means also what we please to call "modernizing"—overhauling the plant if need be, experimenting, planning, finding the most efficient way of doing things.

The editorial pages and advertising sections of *Engineering and Mining Journal*, as well as all live literature in the mining field, have pointed out to the operator many ways to produce better and with more speed. But how far has the mine operator gone? Is he sitting still and waiting for "good times" to come to him, or has he realized, with Mahomet, the position of the mountain? The operator who stands still, even in these times of depression, loses step when the "pick-up" comes. There are few properties the operation of which even under capacity conditions cannot be improved and made more efficient.

Technical Societies and Journalistic Adventure

WE SET OUT, on our return from Washington, clearing up our desk at home. Various circular letters and publications lay in the accumulated pile. Among others was a wrapper which bore the name *Mining and Metallurgy*. Mechanically, almost, we slid it into the waste basket—kindly, respectfully, regretfully; yet expeditiously and without hesitation. And only some time after, when some semblance of order was restored to our desk, did we give thought to the subject. And our first thought was, "Why not write to the Institute and suggest that they discontinue sending this publication, which usually is slid into the waste basket unopened? The Institute needs economical management, and would be glad to save the money; and our waste basket would not need to be emptied so often." But then caution stepped in: "If you do that, it will be thought that you are going out of your way to disparage *Mining and Metallurgy;* and you know very well you do not want that to be thought. Better let that come in with all the other things which might well be spared the mails and for which you have no use."

Recently, *Engineering and Mining Journal*, at the instance of some of the Institute's officers, offered to give the Institute systematic publicity if they wished to spare themselves the trouble and expense of publishing a magazine. The offer was not accepted, and we are well content with the wisdom of the decision. One of our all too candid friends remarked that he was delighted with the prospect, because then he would receive only one paper instead of two; and, being all too candid, he queried further whether anybody read any of the mining journals anyhow. On that principle, of course, and to be sure, the fewer the better. But we can tell him one thing. Everybody who gets *Engineering and Mining Journal* puts up five dollars for it (students, four dollars), and that means the subscribers really want it. And that applies to him. But if he could only get *Mining and Metallurgy* by subscribing separately for it, would he put up five dollars for it, or three, or one?

That is a fair test. A society of mining engineers has gone into the magazine-publishing business. We suppose it must be legal, although they certainly were not incorporated for that purpose. But they are in the business—news, advertisements, editorials, and the whole paraphernalia. Only the subscribers are shanghaied and are not from the ranks of the freeborn. We who write are among the subscribers, and we are here trying to think our way in public out of this situation. So we suggest to the society that it charge a dollar

and a half a year to those members who wish to receive the journal. For it is much more than a bulletin of the society. Such a monthly bulletin the society must have, and it should go to every member.

But at this juncture, in search of material, we rescue our copy from the waste basket and remark an editorial on Socialism and Bolshevism. There is some data on the World Production of Coal in 1920, reprinted from the U. S. Geological Survey. There is a report of a report on differential flotation reprinted from the Bureau of Mines. It has two pages of "Industrial News and Developments" which is maintained on account of the advertisers. It abstracts important papers in current periodicals, and so on. Yes, there is no doubt about it: it is not a monthly bulletin of the Institute, but a venture in the field of journalism, with something of the flavor of the *Mining Magazine* of London, but not so compact. It is a new business competitor.

We love our competitors: but, little brother, the field is very crowded; and if it were not for shanghaied subscribers, provided for you by your daddy the Institute, you would stand the same chance as the proverbial snowball in Hades. But as a remittance man, you doubtless can always get a square meal. You may have read our editorial on the National Geographic Society last week or the week before. It gave us a big idea. The Institute and the American Mining Congress are going into the business of aggressive journalism. Why should not the *Engineering and Mining Journal* go into the Mining Society business? There is always room at the top.

The Value of Gold

WITH INCREASING AMOUNTS of gold being concentrated in this country, the accumulation becomes properly viewed either as an asset or a disadvantage, according to developments. Our gain is the loss of other countries. Some of them, like Russia and Austria, are not only without gold, but are down and out; others, strange to say, without gold and with the flood of paper money which means national bankruptcy, are nevertheless increasing their industry and becoming more prosperous. Such is the case with Germany, whose depreciated currency only allows her to sell to greater advantage in foreign countries. How France and Italy are going to return to the gold standard, if ever, is a mystery. Poland is nearly as badly off as Russia in her fabulous flood of paper money.

It is a good thing for us to get the lion's share of the gold in the world, but what is going to happen, as we get so much that other great nations have none? It means that they will have to abandon the gold standard, and our gold will be of no importance to them. But, as the case stands, we will take nothing but gold in our dealings with them. We want to sell them our goods, in order that we may do an active business and be prosperous; but they already are in debt to us to the limit. Having no gold, they can pay only in goods, which we could use very advantageously. But the Tariff Doctor steps in and forbids our taking this form of nourishment, and tells us we had better live on our own fat. So we have our gold and our goods, and our interstate commerce; and the foreign commerce of the world is taken over by those who are willing to trade for gold, goods, or credit. So that it looks as if the medicine which is being given us to cure our depression may keep us abed longer than necessary; and that when we get up we may find that Germany has won the war. Certainly, we are not going to compete in the markets of the world with goods—metallic or otherwise—raised under the expensive culture of a high protective tariff, with the high wages and other costs which go therewith.

It is not, therefore, so much that the possession of so great a stock of gold should make us proud, as that the lack of possession of gold by other powers worries us.

Germany Again to the Fore

AMERICAN metallurgists may as well begin to scrap their smelters, for a recent invention makes them no longer necessary or desirable features of otherwise barren landscapes. Some had about come to this conclusion anyway. In *Commerce Reports* for June is soberly described the latest German invention for the winning of metals. (Can we never stop those Germans?) It is a "simple, rapid and effective method of separating alloys into their metal components and extracting metals from mineral ores." How is it done? Well, that is apparently a dark secret, but the chief factor seems to be a "catalytic agent." "Big blocks" of alloy go into solution in less than thirty minutes. "Out of the solution thus obtained the various metals are dissected by the employment of simple methods of chemical reaction, which permit the retaining of the metals one by one." (A trained dissector evidently needed; also a civil engineer, possibly, to build a retaining wall.)

Concentrated ores can be treated in the same way but require one or two more operations. "The catalysator (page Mr. Webster) employed can be bought in the open market in any quantity required (an obvious advantage), the greater part of it being recuperated in the process and used again." (It probably needs to recuperate after the strenuous work it must have to do.)

Among the many advantages over present methods are the relatively small expense involved, and the simplicity of installation and appliances (the whole thing sounds simple to us); also the elimination of the melting process does away with the need for coal. "The process is effective with any number of metal components, every metal being recuperated separately, and in the case of concentrated mineral ore, every component metal part, be it silver, antimony, tin, lead, nickel or copper, being retained one by one in the purest form." (Further experiment, with the advice of a lawyer who has been paid a good retainer fee, will no doubt permit of the metals being retained two by two, thus permitting double efficiency.)

"The inventor of this process is Mr. Harry Pauling, of Berlin, who has attracted much attention for his work along these lines." (Very likely.) Herr Pauling has the wire mills doomed too, for he has also developed a method which "enables one to procure copper wire directly out of the electrolytic bath, thereby eliminating the melting down of the electro blocks obtained under the old process, the rolling of the blocks into plate, and drawing into wire." (Gosh! No wonder we've been selling wire bars to Germany.)

We are glad to see that the foreign representatives of the Department of Commerce, with the inspiration of leadership by a mining engineer, are not overlooking the latest in metallurgical development, and it is no fault of theirs or ours if our readers still cling to the old methods.

WHAT OTHERS THINK

Waste in Phosphate-Rock Production

My attention has been called to an error in my article in *Engineering and Mining Journal* of April 23, 1921, entitled "Waste in Phosphate-Rock Production." The error occurs in paragraph 2, column 2, page 710, the first line reading: "A recently conducted experimental plant," etc. This should read as follows: "An experimental plant operated at one time by the Balaklala Copper Co., conducted under the Cottrell process," etc.

It was not intended to convey the idea that this was used for the purpose of phosphoric acid precipitation. I had been keeping in touch with the department at Washington, D. C., and from the information I had received I did not feel justified in publishing in advance any such information. The remainder of my article will show that I was merely writing of smoke- and fume-control. Also, all hard-rock phosphate mined in this section is still being graded for the acid treatment, as we had not been advised of any perfected commercial installations for the purpose of phosphoric-acid precipitation by the Cottrell process. STRAUSS L. LLOYD.

Inverness, Fla.

Getting the Tariff Out of Politics

Referring to the article on "The Tariff on Minerals" in the issue of June 11 of *Engineering and Mining Journal*, by Marc Pawl, your caption calls it a "novel view." It appears to me a common-sense, practical viewpoint, as applied to those minerals of which the United States has an insufficiency, especially for war purposes—such as manganese, chromite, mercury, antimony, and tungsten. If it were possible for an individual, firm, or corporation to own the above minerals, in place of the many owners throughout the whole United States, would it not be good business to conserve the small known amounts of these minerals, by admitting them duty free; conserve for possible war emergency our known supplies?

Again, tungsten, as an example. Is it right or fair to tax 106,000,000 people (the consumer always, ultimately pays the bill) $10 per unit, the proposed tariff, for the benefit of less than 100,000 people who may be interested in its production? Why not let China, with her cheap labor, supply us at $3 to $4 per unit? Some two years ago, Frank L. Hess, in charge of the tungsten minerals department of the U. S. Geological Survey, published a bulletin, advocating that no tariff be placed upon tungsten ores, because of our known scarcity, and its importance, as an alloy for high-speed tool steel, in case of war, and its then being unobtainable elsewhere. Is this not plain common-sense business, such as any individual would exercise, if possible? Antimony is very essential, in the hardening of lead for shrapnel purposes, and there are small known supplies in the United States.

Something is wrong in the estimates of costs of the mercury producers. Except during the late war, the average price, as I recall, for many years, was around $40 to $45 per flask. One cannot believe that they would continue to produce for many years at such a loss. The tariff question is largely a selfish one. Consider that within an area of a radius of 100 miles from Boston there is more wealth than any like area in the United States, built up, made from a protective tariff of the various manufacturing industries. Can you name a single tariff-protected article, or industry, except the porcelain, during the last thirty or more years but what has become very wealthy? All the owners' heirs are millionaires. When one can see, in a foreign country, Mexico, as example, many of these tariff-protected articles sold at retail for one-half the price that the same are sold for in the United States, how can one help believe there is something wrong?

The American laborer gets a better wage, because he earns it. Our improved machinery permits him to produce more. The tariff is only an economic question. Take it out of politics. Place it in the hands of our best scientific economists. G. L. SHELDON.

Denver, Col.

Engineers à la Mode

Even a casual reading of current technical journals cannot fail to leave an impression of the present-day emphasis on certain managerial problems which may be grouped under the term "The Human Factor" and include among others Adjustment of Wages, Americanization, Compensation, Employment, Industrial Relations, Housing, Mental Factors in Industry, Civic Service, Prevention of Illness, Vocational Rehabilitation, and Welfare. When discussion of such subjects forms so great a part of the committee work of the A.I.M.E., it is small wonder that the framers of the model licensing law hesitated to define the word "engineer," or that we find Mr. Hoover speaking of "the drift of the profession from purely technical functions."

In the directory of the A.I.M.E. only about a fourth of the members are avowedly administrators, half are practicing engineers, and a remaining fourth are of other or unstated occupations. Admitting that many engineers graduate into the administrating class, and that many others wish to do so, it must also be admitted that a vast number of administrators were never engineers, have had no technical training, and rose from office or operating departments other than engineering. Perhaps the actual situation could be expressed by "the drift *into* the profession of purely *untechnical* functions."

Directors undoubtedly recognize that executives in certain lines should have a technical or engineering training, and it appears that many ambitious men have thought to take advantage of this preference by a short cut, and therefore style themselves "advertising engineers," "economic engineers," "efficiency engineers," "industrial engineers," "sales engineers," "welfare engineers." Yet one wonders how much there is of common interest between the really technically trained man and these social and psychological engineers.

There is an illusion that the mere name "engineer" will bring prominence to the person using it. Sometimes it may, but the misuse of the term by individuals certainly adds nothing to the prestige of technical men in general who have worked for the right to be called engineers. At the root the illusion consists in believing in the form rather than the substance.

Has not the propaganda by social writers aided in getting us away from first principles? Engineering is not a question of amusement, caprice, culture, emotion, morale, patriotism, sentiment, or subconscious mentality.

All these things may have their legitimate devotees, or at times they may be a pleasant conversational topic, or a camouflage to obscure one's distaste for real work. We know where to discuss topics of engineering in mining and metallurgy, but why wish onto us everything else in the category of modern thought? Maybe there is a jealous Society of Executives, or American Institute of Ouija Board Operators. MYRON R. WALKER.

Pittsburgh, Pa.

Suggests Federal Universities

The suggestion of J. F. Inglis in *Engineering and Mining Journal* of June 4, to centralize engineering education in "two or three schools completely equipped and run by the Government, if you please," bears a decidedly constructive idea and is worthy of careful consideration. But let us not be limited to the mining or the engineering profession.

For more than a hundred years the Government has maintained two colleges, one at West Point and one at Annapolis, which have no superiors in the world in their specialties. But the recent war taught us that we need more than soldiers. Men of every profession, without exception, are in demand in such an emergency. We are prone, of course, to consider the engineer's phase of the situation, and it was certainly acute, perhaps more so than in the other professions. Witness the fact that two calls went out in less than three months for engineer officers. The age limit was raised to fifty years, and men who didn't know how to stand at attention were hustled into captain's uniforms, given three months in a training camp, and found themselves majors and lieutenant colonels soon after. And when they got to France they worked harder than any other branch of the service. Other units were relieved, but the engineers were on the go, and it is related that some of them were sent from St. Mihiel to the Argonne Forest without a day of rest between.

Not only does the Government use men of every profession in war but in civil life as well. It trains its soldiers, but civil employees must provide their own education, and yet they are paid no more than the soldiers for work involving the same degree of technical skill or responsibility. Prompted, perhaps, by an uneasy conscience, the Government gives a good collegiate education to its Indian wards, who, too often, fail to profit by it, but its white subject, who would eagerly make the most of such an opportunity, must find some means of providing such an education for himself.

Why not one or more national universities? Here men could be trained in the various professions and given such military instruction as necessary to qualify them for commissions in the reserve army. On graduation they would be commissioned and appointed to positions in the civil service, in which they would acquire an excellent practical experience, such as would fit them for positions of responsibility in the industrial world. As compensation for their education they should serve in a civil position for a certain period, on salary of course. If a man desired to resign his position before the expiration of that period, he could do so by the payment of a sum based on the unexpired portion of his term of service.

Thus could be established a uniform and high standard of education and a means of providing the Government with useful men in its civil service, furnishing men of high qualifications for our industries, and creating a trained reserve immediately available in a national emergency. And let it by all means, as Mr. Inglis suggests, lay stress on the business value of an education.

Perhaps such a suggestion doesn't jibe with the present talk about disarmament, but when we see leading nations talking disarmament and taking a hitch in their belts at the same time, and when we remember that Creasey tells of the wise statesman who, several hundred years before Christ, predicted that there would never be another war, we may fittingly recall Cromwell's famous order and proceed to look after our powder, even if the practical realization of such a scheme of education would not be of vast benefit to the development of the country as a whole. LEROY A. PALMER.

San Francisco, Cal.

Judged From an Advertising Viewpoint

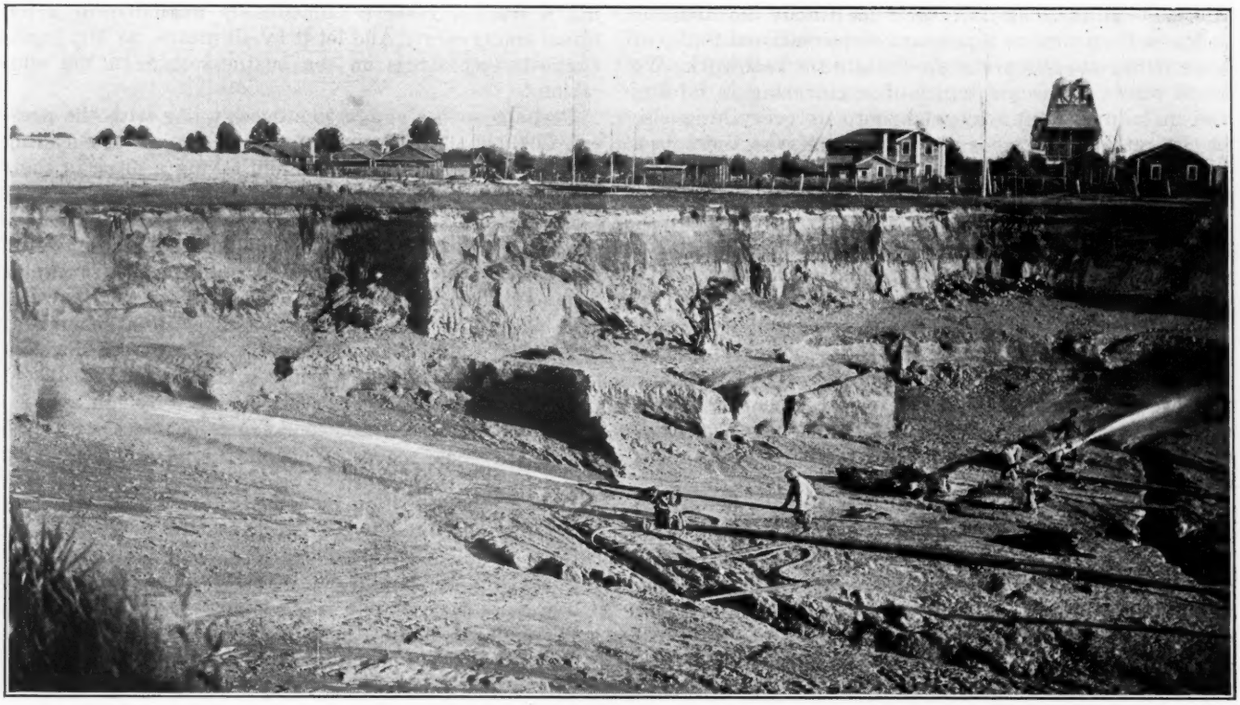
During the last few months I have noted with interest the current comments by Institute members on Institute affairs and publications. In reviewing the opinions already published, I have been somewhat surprised to note that one of the most important causes for complaint, from the standpoint of the technical magazine, has not been touched upon. If the subject has been avoided for reasons of delicacy on the part of the editorial department, no such reasons should deter an outsider from calling attention to the consideration, which I believe may be of importance to the engineer who depends on the leading mining publications for reliable, timely, and well-digested information, in order to keep himself abreast of the rapid developments in his profession.

The point I wish to make is that "Mining and Metallurgy" is increasing its advertising business at the expense of our old friends, the independent mining press, on which we depend for our real, honest-to-goodness, up-to-date, technical information. Anyone familiar with the cost of publishing a first-class technical magazine knows that the subscription price covers only a fraction of the cost of delivering the publication, and that the periodical must depend upon its income from the sale of advertising space. With these facts in view, it seems to me that it is up to the engineer to decide whether he is going to use his influence toward the support of his old friends and servants, who have been faithful to him for many years, and on whose ability and desire to serve him he can depend, or whether he intends to "dull his palm with entertainment of a new-hatched, unfledged comrade."

An expansion of the policy of engineering societies to issue magazines, and attempt to support them by securing advertisers, using their membership lists as selling arguments, will surely undermine the very foundations of the engineer's reliable sources of current technical information. He must realize that the general quality of the service rendered by his former faithful servants will be gradually but surely impaired, because they cannot afford to keep up their former and present high standards in the face of a movement to withdraw their financial support.

It is squarely up to the engineer, and the Institute member, to decide what kind of service he wants, and whether he will stand by his old friends, or continue to experiment with a new acquaintance, with the sacrifice of quality and efficiency. HARRY J. WOLF.

New York City.



HYDRAULIC OPERATIONS, TWO "GIANTS" IN FOREGROUND

Phosphate Mining in Florida

Open-Cut Work, Dredges, and Hydraulic Operations the General Practice—Product Is Washed in Log Washers and Converted Into a Fertilizer—Steam, Gas, and Electricity Used as Motive Power—Typical Installations Described

BY STRAUSS L. LLOYD
Written for *Engineering and Mining Journal*

FLORIDA PHOSPHATES are classified into hard-rock, soft, land-pebble, and river-pebble grades, and are found in the Eocene, Miocene, and more recent geological formations. Hard-rock phosphate occurs in massive and laminated forms, or as boulders piled together; also as pebbles when broken by weathering and water movements. It possesses a variable structure, from compact to fibrous, and although usually of a creamy color, is frequently found stained with iron oxide.

The soft phosphate occurs in deposits by itself or associated with hard-rock phosphate and may be clayey or sandy, filling spaces between boulders of hard-rock phosphate. It is evidently a secondary deposit formed by the disintegration of other phosphates of lime. It carries from 20 to 30 per cent less phosphate of lime than hard rock, which contains from 80 to 86 per cent.

Land-pebble phosphate is essentially an aggregate of hard whitish phosphate pebbles varying in size from grains to pieces one inch in diameter, averaging possibly a little over one-quarter inch, and having usually a matrix of phosphatic clay and sand. The percentage of phosphate of lime which the pebbles contain is from 75 to 80, but the average material as mined does not reach this standard. The mineral is mined either by open cuts, by dredging, or by hydraulicking, to be washed dried and shipped to fertilizer works, generally situated abroad.

River-pebble phosphates are found as bars in rivers of southern Florida, and with them the fossil remains of vertebrates. The river-pebble variety is blue or black, varying from one inch downward in size, and frequently occurring as the hardened casts of small molluscs. It is presumed that river-pebble phosphates are derived from land-pebble phosphate, and also from hard-rock phosphate. The percentage of phosphate of lime in the river-pebble type is between 58 and 68. At present river dredging for phosphate is not as active as land-pebble mining operations.

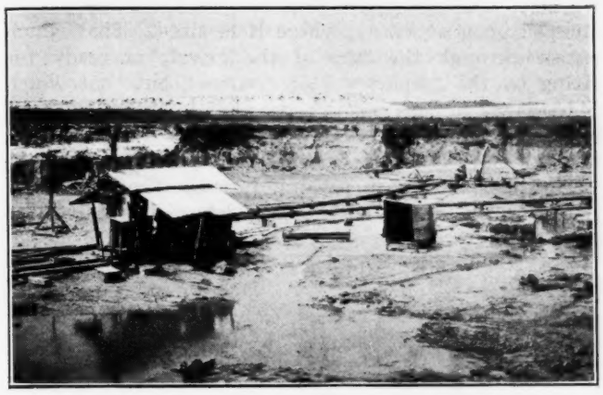
STEAM SHOVELS AND HYDRAULIC METHODS USED FOR REMOVING OVERBURDEN

Florida phosphate beds are covered with soil of varying depths, which is removed by steam shovels or hydraulic nozzles. If the deposit is below the water level, traction dredges working on land, or floating dredges, are used.

The overburden of land deposits is stripped by steam shovels, a cut being taken the full swing of the shovel boom, and the shovel moved forward a short rail length when the cut is finished. The capacity of the dipper or shovel varies from 1 cu.yd. to 2½ cu.yd., and the boom and dipper arm is made to conform to the depth of the alluvion. For example, a 35-ft. boom will raise material 18 to 20 ft. above the shovel track and make a cut 35 ft. wide. The cars to carry the over-

burden are standard-gage of 12 cu.yd. capacity and are usually dumped by hand, although some of the more recent cars have air-dumping equipment controlled from the engine cab. They are run out to the dump, care being taken not to waste the material where it will cover future work. Steam-shovel work is done by contract. The price was about 20c. before the Great War, and about 35c. before the present slump in the price of phosphate rock curtailed mining operations.

Wherever conditions are favorable and space is available for the disposal of the material, the overburden is



PUMPHOUSE AT LEFT, DITCH AT EXTREME RIGHT

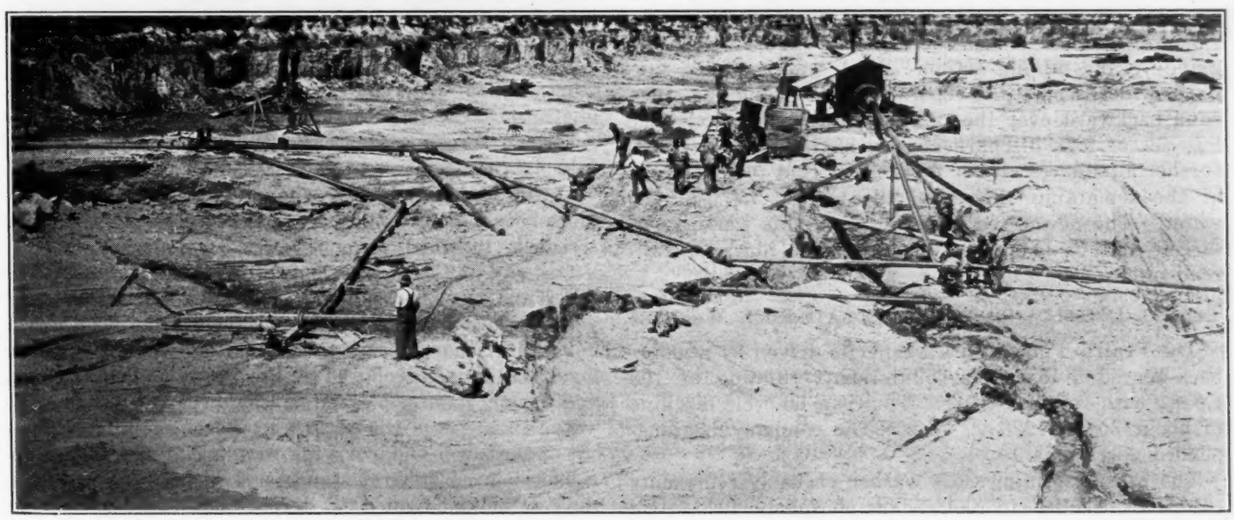
removed by hydraulic methods, and pumped into an abandoned excavation from which the phosphate has already been removed. The cost of stripping by hydraulic methods is from 10 to 15c. per cu.yd. The overburden in Florida phosphate fields is favorable for this kind of work, being clean, fine sand, with some pebbles, the majority of the foreign substance being sods, stumps, and palmetto roots. Occasionally the sand is cemented and grades into a soft but tough sandstone which must be blasted before hydraulicking. Owing to the overburden containing little clay, it can be stacked in large dumps that do not liquefy and run to the streams.

In Florida where hydraulic stripping is practiced hydraulic mining may also be used and the material broken by playing one or more streams of water under a pressure of from 90 lb. to 140 lb. per sq.in. against the face of the deposit, an operation that causes the rock containing the phosphate to crumble and flow into a ditch cut in underlying marl. The flow is aided at times by additional water from a ¼-in. nozzle ditch-hose, the object being to drive the material into a sump about 8 ft. square, also cut in the marl. From the sump the material is lifted by an 8-in. or 10-in. centrifugal pump and discharged into log washers. As the rock material consists of firm sand and round phosphate pebbles, little of it being over 1½ m. in diameter, it is easily made to flow through the ditch into the sump, on a grade of two inches to the foot by the use of about ten times its weight in water.

The hydraulic nozzles are connected to the main water-supply pipe, usually 10 in. in diameter. When two nozzles are worked, each has from 200 to 500 ft. of 6-in. diameter, flanged, spiral-riveted, galvanized water-pipe. Asphalt roofing paper or tar board is used for flange gaskets. At one or two convenient places, in the 6-in. line, a ball-and-socket joint is applied to facilitate lateral movement of the nozzles.

When two nozzles are used they are pointed so as to wash the material to a central point, which is the ditch leading to the sump. If the ditch clogs, an auxiliary hose is coupled just back of the nozzles, and the flow of water from this is used to move the material to the sump. After the face of the rock is mined far away from the sump so that the material does not flow properly through the ditch, a new sump is blasted 50 to 75 ft. nearer the working face, and the pump moved to it. The pressure required for this hydraulic mining is not high, but the work demands a large volume of water in order to transfer the material through the ditch to the sump and so as not to choke the pump by an excess of solids.

The machinery for transferring the phosphate rock to the washer consists of a centrifugal pump of the vol-



ARRANGEMENT OF PIPING, DITCHES, AND PUMP

ute-box type, with a chilled cast-iron facing, directly connected to a slip-ring motor. The tail-piece of the pump, which must be made flexible, is raised from the sump by means of a set of triple blocks suspended from a tripod. This arrangement is necessary, because wherever the mouth of the suction pipe becomes clogged with grass, roots, or other impediments it must be raised out of the water for cleaning.

If the distance is more than 800 or 900 ft. between the mine pump and the washer, a relay pump is usually installed. In such cases the mine pump discharges into a sump from which the relay pump draws its material, and forces it to the log-washer. A sump is used owing to the difficulties arising from back flow and water hammer when operating two centrifugal pumps in series. When the centrifugal pump discharges without much head, the end of the pipe line is elevated for a pipe length at an angle of 45 deg., to furnish sufficient pressure to work against, and prevent vibrations of the pump.

Most of the new phosphate plants are equipped with both steam and electricity for driving machinery. The 8-in., and 10-in. centrifugal pumps are driven by General Electric motors of the slip-ring induction type, 60-cycle, 75 hp., 2,000 v., and 21½ a., with street-car controller having three resistances, a Thompson ammeter, and an oil circuit breaker. Pump, motor, and other parts are mounted on skids, so as to be readily moved, and the motor is covered with a light frame house. Practically all the water pipes and pump pipes used in the Florida field are of steel, with peaned flanges and cardboard gaskets. The flanges, which come separately, are generally put on by men working on contract.

After the material reaches the washer it is delivered to a relay pump without going into a sump. This pump lifts the material to the top of the washer, where it is discharged into a launder that feeds a cylindrical screen, having 1¼-in. holes. The screen makes two products: oversize consisting of mud balls and coarse rock sent directly to the tailing pond, and an undersize, discharged on an inclined stationary screen with 3/50-in. slot openings, where some of the sand is removed, the operation being assisted by sprays of water. The oversize from this screen passes to a 16-ft. double log washer, which discharges the material into another 16-ft. single log washer. These logs separate the particles of phosphate, sand, and pebble from the silica by reason of their grinding and mixing action. Wash water is also supplied, which assists the separation by forcing the silica sand backward over the tail-gate of the log box. The last set of logs discharge on a shaking screen, which further eliminates all but from 6 per cent to 8 per cent of the remaining silica and the greater part of the water. The dewatered material from this screen goes directly into a hopper-bottomed storage bin over railroad tracks.

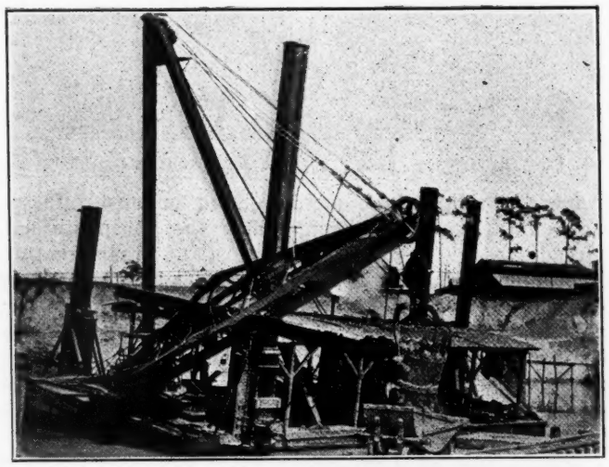
Typical Installations of Phosphate-Rock Washers

The Prairie Pebble Co.'s washer is driven by a motor back-geared 5 to 1, the countershaft running at 103 r.p.m., with sprocket drive. This is a 60-cycle machine of about 30 hp., 220 v., 75 a. The company has suspended operations.

The Florida Mining Co.'s washer probably represents the best practice in the pebble-phosphate field. Its special feature, aside from its superiority in heavy structural work, is the method of passing mud balls and coarse phosphate pebbles to a roll crusher, to be disintegrated and discharged to the log washers in such condition that it can be cleaned readily. The log washers are double 20-ft. logs solidly constructed and well designed, paddles being large and heavy. The central spindle of the log is a heavy hollow shaft, to which the paddles are bolted with lock nuts, a feature superior to the four separate angle irons used in some other logs. The angle-iron logs, however, have one advantage in that there are no stuffing boxes at the tailing end, these being replaced by a chilled cast-iron gudgeon and bearing, supplied with fresh water to keep out the grit.

The hydraulic and steam-shovel methods of stripping the overburden and the hydraulic methods of removing the overburden as already described apply to hard-rock phosphate mining and soft-phosphate operations. In the pits in the hard-rock section, steam dipper dredges are used, which load the skips hauled up an incline railway, delivering the phosphate rock to the top of the washer. The phosphate thus carried from the pits is dumped upon a grizzly, where it is sized. That which passes through the bars of the grizzly is ready for sizing by the "separator" or trommel, but that which is too large to pass through the bars is broken by hand with a pick, axe or dynamite, and made ready to pass through the bars of the grizzly.

The phosphate rock passing into the "separator" is sized for the set of log washers where it receives its



DREDGE LOADING A SKIP

treatment for the removal of adhering clay. The phosphate too large to pass through the perforations of the revolving screen passes out of the lower end and falls into a jaw crusher and then through a chute into the first set of log washers, where it is washed with the phosphate which has already been sized by the revolving screen or trommel.

One end of the log-washer revolves in a gudgeon; the other end works in journals. The log, driven by gear wheels, works the phosphate rock toward the head of the box and discharges into the second log washer, a single log. Water is introduced at the upper end of the box, and the phosphate rock fed at the lower end. The clean water thus meets the rock, and, becoming dirty, flows out of the lower end, carrying with it clay in suspension.

There is no general standard for these log washers, the box being about 4 ft. deep at one end and 2 ft. at the other, according to the length of the logs, which varies from 16 to 30 ft., and pitched at an angle sufficient to give rise of 1¼ in. to the foot. The dirty water from the washers generally flows away in sluices, but where the grade is insufficient a centrifugal pump is used to assist in its removal.

After the log washers have removed most of the clayey matter, the phosphate passes through a chute into a trommel having an internal spray, to eliminate the remaining clay and smaller portions of the sand.

These screens have jackets, and are commonly called "rinsers." The phosphate, after passing through the "rinser," falls through a chute on a slowly revolving "picking table," where boys and men pick out the "sand rock" and other foreign matter not removed by the log washers and screens. The phosphate, after hand-sorting, is automatically pushed through the center of the table by a large brush or scraper, into a chute leading to a car under the picking table, in which it is carried to the drying shed, to be either kiln dried or dried in a mechanical drier, reducing the moisture to a required 3 per cent.

The excess of moisture in the hard rock in this section of Florida during the early days of mining was removed entirely by kiln burning, a process still in use by many operators, in which the phosphate rock is placed on ricks of wood and the wood fired, the phosphate partly smothering the flames, permitting slow burning, and by the gradual spread of heat, becoming more or less uniformly dried. In addition to removing moisture, this step also eliminated a great deal of the adhering sand and carbonate of lime.

When hard-rock phosphate predominates, it has heretofore been regarded as the sole product of the mines, as the soft phosphate is all washed out after passing through the crushers and into the log washers, where about 90 per cent of the mine material is thrown out as waste matter, a condition regarded as a limiting factor in mining hard-rock phosphate.

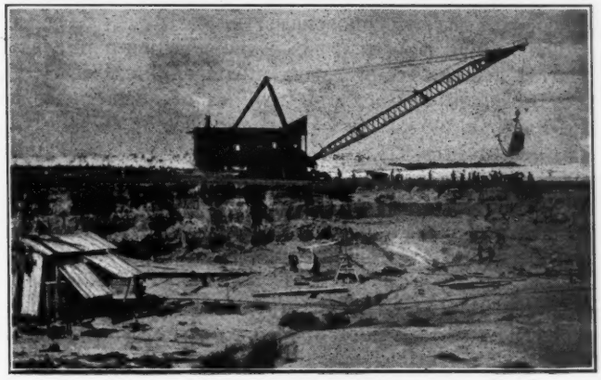
It has not been considered profitable to operate a mine when less than 10 per cent of the material handled is recovered as crushed phosphate. During the Great War, while mines were standing idle, plans were perfected for mining of the soft phosphate, even where no hard rock exists, and this has led to the opening of additional mines from which an immense tonnage of "soft" phosphate will be added to the supply of material. In general, the plan is to mine the soft phosphate as near as possible in pure form by eliminating the adhering clay and sand, to haul it up the incline to mechanical driers, where it is practically freed from moisture, and then to pass it through mills, reducing it to a fine powder, after which it is to be shipped in bulk or in bags, as desired by the purchaser.

This method differs from the ordinary handling of hard-rock phosphate in that it does not require crushing, except to break up lumps, and that the soft rock will not stand washing, as it is not and never has been "rock," but a finely powdered material resembling gray chalk or potter's clay. When any attempt is made to wash it, the entire mass is dissolved and becomes suspended in the wash water, from which it can be liberated only by evaporation. When it is brought to the phosphate washers in mining hard-rock phosphate, and passed through crushers before it goes to the log washers, all of the soft phosphate is lost, being carried away in the wash water with the rest of the debris.

PHOSPHATE USED DIRECTLY AS FERTILIZER OR CHEMICALLY TREATED

Nearly all of the pebble phosphate mined in Florida is used in the manufacture of acid phosphate and is the principal source of material used for this purpose. It contains about 32 per cent of phosphoric acid and is mixed with equal weight of sulphuric acid, yielding acid phosphate containing about 16 per cent phosphoric acid. Hard phosphate rock contains about 37 per cent of phosphoric acid, and brings a better price for export than for domestic use. Little of it is used for making acid phosphate, or ground for use as raw rock phosphate. Many of the mines in the pebble district are now owned by fertilizer manufacturers who send all of the products of the mines to their own plants, where it is largely used in the manufacture of mixed fertilizers.

This leaves soft phosphate as the only material which the farmer can buy in unlimited quantities for use without other treatment after it leaves the mines, and as it is neither suitable for use in the manufacture of acid phosphate, high enough in grade, nor in the proper form



A DRAG-LINE SCRAPER

for export, the only satisfactory use for it is to apply it direct to the fields.

Most of the mines supplying this material guarantee it to contain 26 per cent of phosphoric acid, as compared with 32 per cent pebble phosphate and 37 per cent hard-rock phosphate. It has been shipped and sold to a considerable extent for use on the farms of Georgia and the Carolinas during the past few years, many farmers testifying to the good results obtained. Unfortunately, practically no experimental data are available from the state experiment station as to its value, so every effort is being made to have it thoroughly tried out during the next year or so, and thus obtain reliable data as to how it will compare with other forms of phosphate as a fertilizer.

It is not claimed by those who mine and sell soft phosphate that it contains any more available phosphate or phosphoric acid than the pebble or hard-rock phosphate, but they emphasize the claim that when dissolved in soil water it assumes a finer state of division than it is possible to crush any form of rock phosphate. It appears on examination to be as fine as chalk or talcum powder, though no definite determination has so far been made as to the exact size of the particles.

It is claimed with good reason that, in the use of ground rock as a fertilizer, its value is in direct proportion to its fineness. It is customary in acid-phosphate plants to grind it to pass through a 60-mesh screen, and it was first used as raw rock phosphate in this form. Later, machinery was provided for grinding rock to pass through a 100-mesh screen, and it is possible that those who are interested in selling ground rock will perfect methods for economically grinding it so fine that it will pass through a 200- or 300-mesh screen. One soft-rock phosphate miner ventured the opinion that soft phosphate would easily pass through a 300-mesh screen, but no experiments have been made to test this statement.

If the claims made by soft-rock phosphate companies, that this material exists in such a finely divided state

that it readily becomes available after a few days' action of soil water and mild organic acids derived from decaying vegetable matter, are substantiated, this material may thus be popularized as a fertilizer in states near enough to the mines to make its transportation feasible. Soft phosphate can be used alone in heavy or light applications, as it is not subject to leaching, or in combination with any other fertilizer material with which the user desires to mix it. Some of the soft-rock phosphate miners have already arranged to make up mixed goods using the soft grade in the fertilizer, and are selling it in competition with mixed fertilizers made with the acid phosphate.

The motive powers used in the phosphate mines of Florida are the reciprocating steam engine, electricity, the Diesel oil engine, and turbines of such makes as the Parsons 300-kw. type. The Charleston Mining Co. at Fort Meade, Fla., has a 1,000 kva. vertical Curtis turbine and is installing a 600-kva. horizontal turbine of the same kind. For a smaller unit of 3,000 kva. and less, the horizontal turbine is preferable, by reason of the absence of the forced-feed step-oiling system, such as is necessary in the vertical type. The chief advantage of the turbine over the reciprocating engine is its simplicity, low cost, ease of upkeep, and the possibility of using a lower-priced operator. It is also much more compact than the reciprocating engine.

Heaviness of construction is noticeable in all equipment in Florida phosphate fields. Much construction is reinforced concrete and steel, so that almost perfect rigidity is obtained, a feature essential for economical operation and successful working of shafting. When supports are not entirely rigid, ball-and-socket pillow blocks are used. Heavy stationary rigid pillow blocks are used in large sizes, placed on end-adjustable base plates.

Lubrication is principally by means of grease cups, on account of the excessive dust, which precludes the working of chain oil-bearings; however, in places where dust is not excessive the self-oiling pillow block is not only more economical in oil, but requires attention only once a month and uses a grade of oil giving a lower coefficient of friction. On account of the excessive amount of dust and grit about drives, sprockets and chains are almost universally adopted for transmission of power. Heavy chains are used. It is noticeable with all of these drives that none exceed the proper speed for chain, viz., 500 ft. per minute. Manganese chains are being adopted with excellent results.

Where belts can be used, chains should not be given preference, as a well-designed belt drive will last for years. The only reason that belts give so much trouble and wear out so quickly is that they are over-stretched, the designers failing to give sufficient attention to installations. A belt drive properly installed is from 6 to 8 per cent more efficient than chain drive. No rope drives are used in Florida, on account of the universal employment of electric power. Hard-rock phosphate miners use steel cable on their re-hauls and to haul skips up inclines to the log washers, the steel-cable drum house being at the top of the washer and near the log washers.

Wet-rock elevators are placed at 57-ft. centers. These elevators have a pitch of four 3.41 in. per ft.; elevator buckets, 8 in. x 18 in., have round bottoms. Manganese chains work on an 18-in. traction tail pulley and 30-in. traction head pulley traveling at the rate of 235 ft. per minute. Dry-rock elevators are similarly constructed, but their length is divided into two vertical lifts, to reduce the weight on each chain. These elevators have given perfect satisfaction, the use of manganese chains insuring long life and freedom from breakdowns, repairs, and frequent renewals. They are all single-strand elevators, which obviates any trouble with unequal wear on chains. However, unequal wear may be reduced by leaving one of the tail sprockets loose to permit ascending buckets to rise parallel.

The majority of mechanical driers are of the rotary type, set level, the material being fed at the cold end and worked to the hot end by spiral flights on the inside of the shell. All of the driers are oil or coal fired, which accounts for their large capacity and easy operation. The only objection to rotary driers is their use when the rock contains clay that clogs the spirals, which reduces the heating efficiency of the drier, taking longer to do the work. Rotary driers are about 50 ft. long and require about 5 hp. to drive them. Their capacity is about 100 tons of well-drained sand in ten hours, or 120 tons of phosphate rock. To dry this quantity of material requires from five to six tons of coal. One man can fire two driers with coal, provided the coal is placed in front of the furnace.

The most noteworthy part of the construction is the type of storage bins of all the plants. One plant has a reinforced bin 525 ft. long and 75 ft. wide by 30 ft. deep, not including the clearance over the tracks. It has three compartments, with four tracks overhead and three tracks underneath. The storage shed built by the Phosphate Mining Co. has, as a special feature, an overhanging side, giving a cantilever, which allows the bins to project over the railroad tracks. The mill building, or that part over the driers, has reinforced concrete columns, with slab floors having reinforced beams. For a considerable tonnage in the Florida field large storage bins are desirable. The storage bin of moderate capacity, say 20,000 tons, would cost about $80,000, representing a charge of 2⅔c. against 3,000,000 tons. The ordinary storage shed with an electric crane would represent a charge of only .003 mill per ton. Judging from these figures, the ground-level storage with an electric crane is cheaper for loading from storage pile into the cars.

Scale-Forming Matter in Blast Furnace Jacket Water

Corrosive or scale-forming matter in water often causes considerable trouble when the water is used for cooling in the jackets of blast furnaces. This is particularly true in operations where the water reaches the boiling point. At Broken Hill, in Northern Rhodesia, according to a short paper prepared for the Australasian Institute of Mining and Metallurgy, several jackets were burned through, and the difficulty was remedied by placing bundles of wattle bark in the hot well at the rate of one ton per month. This extracted the tannin and added from one-half to one part of that substance to 100,000 of the circulating water. During the last two years since the wattle bark has been in use, no jackets have been burnt, and stoppages have been reduced from sixteen to four hours per month. Any scale which forms is of such a porous nature that it can be easily removed.

In a wattle-less district, no doubt any other bark containing a fair proportion of tannin would answer equally well, or a predetermined amount of soda ash might prove effective.

Dredge Construction at Dayton, Nev.*

Erection of Steel Hull and Dredger Equipment—Camp Organization—Sequence of Construction—Labor Input and Cost—Design Made To Conform to Important Parts Obtained From Dismantled Dredges

BY GEORGE J. YOUNG
Western Editor, *Engineering and Mining Journal*

DURING 1920, the Gold Canyon Dredging Co. completed and put in operation a 9-cu.ft. bucket dredge for the working of an alluvial gold deposit situated between Dayton and Silver City, Nev. As the dredge was constructed in part of dismantled material and machinery from two dredges owned by the Marysville Dredging Co. at Marigold, Cal., and in part of new material fabricated in San Francisco, and as much of the construction equipment and miscellaneous material required were drawn from a number of places in both Nevada and California, there were unusual problems in both design and construction. Good engineering was required in evolving the dredge plans about existing major parts and in marshalling the material in proper sequence at the dredge site in such a way as to provide continuous occupation for the erection gang and to secure a minimum construction cost. The work was under the supervision of Gerald H. Hutton, and despite unusual delays beyond the control of the company, the dredge was finished and put in operation within a relatively short time.

The ground to be dredged consists in part of streambed material and in part of a stream terrace lying west of the natural waterway and sloping down toward the Carson River. The estimated acreage is 115.3, not including probable extensions that might result from further prospecting. The highest point, about two miles from Dayton, was selected as a site for the construction of the dredge and for initial operations. Dayton was selected for a camp and headquarters as it is on a branch of the Southern Pacific R.R. extending from Churchhill to Mound House. The distance from San Francisco is 337 miles by rail and the operation is 264 miles from Marysville, both of these points being the beginning of rail transportation for the principal parts of the dredge. Machine-shop facilities are available at Carson City and Reno, both accessible by road and railroad. A spur track was put in jointly by the company and the Southern Pacific at Goldy, between Dayton and Mound House, and this was the railhead for the receipt of all material except that locally hauled from near-by points. Over 2,000,000 lb. of material and equipment were transported by rail and hauled over the one mile of road from the spur track to the dredge site.

COMFORT OF WORKERS MADE A PRIMARY CONSIDERATION

Dayton was selected for housing and headquarters on account of its convenience and relative accessibility. The plan of providing auto truck transportation for the workers during construction and operating was considered preferable to the erection of a camp in the near neighborhood of the dredge. Two houses were purchased to serve for boarding house, club room and office, and temporary arrangements were made at the start of operations for housing and boarding at a local hotel. Three residences were leased for married employees, and a garage was constructed for automobile and auto truck.

A water system, cesspools and accessories and provision for fire protection were made as speedily as possible. The company provided a club room, with furniture, heat, light, and shower baths, the men furnishing other accessories and taking care of the room. All this was done after consulting with local health authorities and under the general direction of Edwin Higgins. There was thus provided a small, well-organized community. As the operating period was estimated to be five years, and the construction period as it happened covered almost a year, the importance of these arrangements will be appreciated.

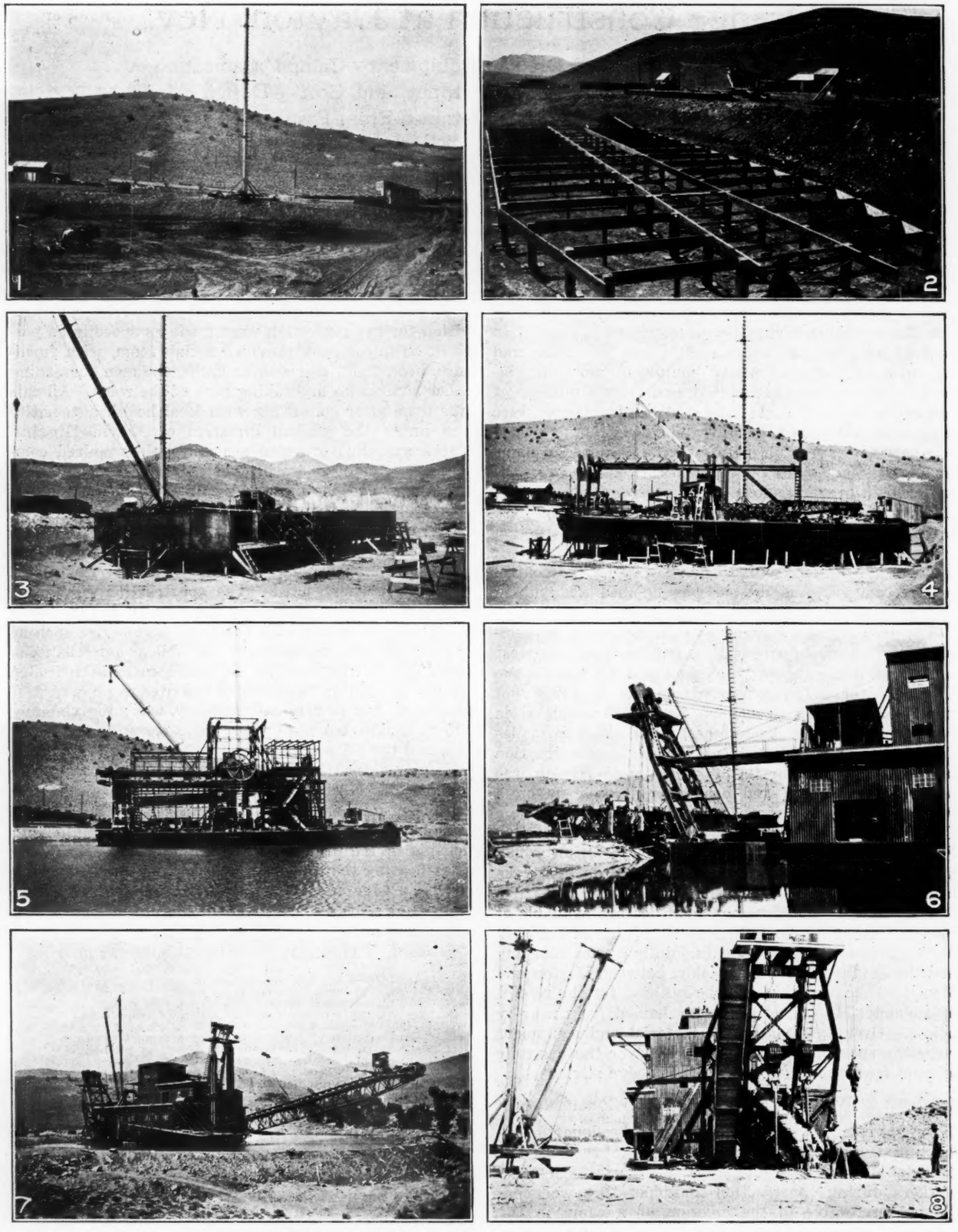
At the dredge site temporary buildings consisting of a storeroom, shop, compressor house, and derrick motor house were constructed. The construction equipment consisted of two compressors, one 10 x 10 and the other 8 x 8, and a derrick with hoist and accessories such as power line and transformers, as well as miscellaneous tools. The road between the railroad spur and the dredge pit was graded and graveled. The dredge pit was first excavated, and, as originally planned, was approximately 170 ft. square, but hard ground was encountered on one side and the pit was narrowed to 140 ft. The sequence of major operations was as follows: placing of hull foundations, erection of hull, installation of mechanical equipment and parts, placing of stacker and bucket line, installation of motors and miscellaneous equipment, housing of the dredge. Part of the erection was done after floating the dredge, which permitted maneuvering of the dredge in the pond. The time sequence and significant features are given in the chronology or log which follows:

TABLE I. CHRONOLOGY OF DREDGE CONSTRUCTION

1919
Feb. 1-April 24—Property prospected.
Aug. 23—Started work on road from spur.
Sept. 12—Started work on pit.
Sept. 30—Shipyards closed down by strike of employees.
Oct. 10—Gold Canyon draftsman started work at Marigold.
Oct. 11—Installation of construction transformers begun.
Oct. 26—Construction of temporary buildings at pit begun.
Nov. 9—Construction of railroad spur begun.
Nov. 24—Shipyards reopened for work with small force.
Dec. 1—Railroad spur completed.
Dec. 1—Compressor installation completed.
Dec. 4—Cesspools at office and boarding house completed.
Dec. 5—Storehouse construction begun.
Dec. 9—First carload arrived at spur (from Marigold).
Dec. 13—Installation of derrick winch begun.
Dec. 15—Boarding house opened.

1920
Jan. 14—Redwood pipe for water supply arrived.
Jan. 15—Power on.
Jan. 19—Two-ladder section arrived from Marigold.
Jan. 19—Overhead traveler above spur in operation.
Jan. 23—Pit completed.
Jan. 31—Outside telephone line connected.
Feb. 1—Foundation of hull installed.
Feb. 3—Water service to compressor completed.
Feb. 5—Power applied to machine shop.
Feb. 5—Installation of 8-in. water supply pipe line started.
Feb. 12—Dredge telephone line connected.
March 5—First carload of structural steel arrived at spur.
March 7—First carload of steel arrived at pit, and assembling begun.
March 8—Two spuds arrived; riveting started.

*The monthly construction reports by Gerald H. Hutton, who was in direct charge of this work, were made available for the preparation of this article through the courtesy of the Metals Exploration Co. and the Gold Canyon Dredging Co. The photographs illustrating this article were loaned by Mr. Hutton.



PROGRESS IN DREDGE CONSTRUCTION AT DAYTON, NEV.

1—Excavation of pit. 2—Construction of hull foundations. 3—Construction of steel hull. 4—Erecting superstructure and placing of winches and pumps. 5—Hull floated, part of superstructure erected. 6—Bow gantry in place, and preparations for placing of ladder; deck housed in. 7—Ladder and stacker in place, gold sluices erected. 8—Finishing the bucket line of the dredge.

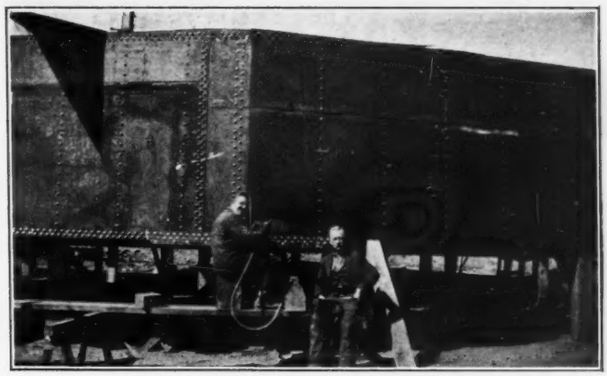
March 9—Pipe line and ditches for water supply to pit completed.
March 17—Two carloads structural steel arrived at spur.
March 19—Two carloads structural steel arrived at pit.
March 27—Fourth carload of hull material arrived at spur.
March 30—Fifth and sixth (last) carloads of hull material arrived at spur.
April 5—Work on 22,000- to 4,400-volt transformer substation started.
April 8—Electric welding of plates begun.
April 9—Strike of railroad switchmen tied up moving of freight.
April 14—Lumber requirements ordered.
April 17—Boarding house transferred to company's property; completion of riveting of bottom of hull; 27,000 rivets driven. Hull material all in place, except a portion of decking.
April 25—Electrician started to repair motors and electrical equipment at Marigold.
May 1—Rivets driven to date, 38,664. Flotation water ordered for June 1.
May 5—Two carloads of structural steel, including bow and stern gantries, arrived at spur.
May 10—Electric welding completed.
May 12—Distributor and tables arrived at spur.
May 15—Two carloads of structural steel, completing superstructure, arrived at spur.
May 17—Power line completed from transformer house to the pit.
May 26—Carload of lumber arrived at spur. Carload of motors and electrical material from Marigold arrived at spur.
June 1—Transformer connections made. Water diverted into American Creek from water company's flumes. Rivets driven to date, 48,391.
June 3—Water turned into pit.
June 6—Installation of electric wiring on dredge begun.
June 8—Dredge floated. Upper tumbler installed in place. Survey work begun on claims.
June 9—Riveting of structural steel practically completed.
June 16—Main drive installation practically completed.
June 22—Last car of essential dredge parts arrived at spur from Marigold.
June 29—Day lost on account of rain.
July 5—Day lost on account of holiday.
July 6—Power on swing winch applied through construction transformers. Bow gantry hoisted and placed.
July 20—Screen installation completed.
July 27—Spuds hoisted in place.
Aug. 8—Power applied through main substation and dredge transformers.
Aug. 9—Digging motor running.
Aug. 12—Ladder and lower tumbler in place.
Aug. 16—Tail flumes installed.
Aug. 17—Stacker lifted in place.
Aug. 18—Power applied to pumps.
Aug. 19—Began installing bucket line.
Aug. 21—Bucket line installed.
Aug. 30—Trial run two hours.
Sept. 3—Trial run three hours.
Sept. 4—Lights on trial run four hours.
Sept. 5—Public initiation of operations at 3:45 p.m. Shift reports started 11 p.m.
Sept. 17—Bedrock encountered.
Sept. 21—Compressor in operation.
Sept. 22—First clean-up.
Oct. 1—Second clean-up.

Water Supply From Existing Flume Lines

A constant water supply is essential in the operation of a dredge, and the establishment of this supply in the absence of a near-by natural source involves natural and often legal obstacles, especially where there are pre-existing water rights and rights of way to be secured. The elevated site of the dredge in this instance made it entirely probable that seepage losses would be a considerable factor and an assured water supply imperative. The water available from natural flow in Gold Canyon was not considered sufficient. A seepage factor was therefore established for the ground from data derived by filling several available shafts with water, and observing and timing subsequent draining. As a result, a contract for a constant flow of water was made with the Virginia & Gold Hill Water Co., which has a water system supplying Virginia City, Gold Hill, and Silver City. This water supply was considered preferable to pumping of water from the Carson River or from adjacent mines.

WOOD STAVE PIPE DELIVERING WATER SUPPLY TO DREDGE POND

Some construction work, in the form of 4,500 ft. of 8-in. woodstave pipe and 3,800 ft. of ditches, was necessary for the delivery to the dredge pit of the clean water purchased, and to keep it separate from the natural flow of the creek, which is often polluted by mill tailings from above. Rights of way were acquired from property holders for these structures, and, in addition, a blanket water right for the creek flow and the water purchased was granted by the State Engineer, subject to the usual qualifications.



RIVETING THE HULL. THE WELDED JOINT IS SHOWN ABOVE THE MEN

During June, the ground to be dredged was laid off in 300-ft. squares from a base line established in the center of Sec. 22 and running east and west. Stakes were set at every 300 ft. on this line, but only every 900 ft. on the N.-S. lines. The points thus derived, together with a few additional stakes set in prominent places, were intended to serve for spud locations. The stakes used were ¾-in. iron pipe projecting 9 to 12 in. above the ground and provided with a metal flag suitably marked.

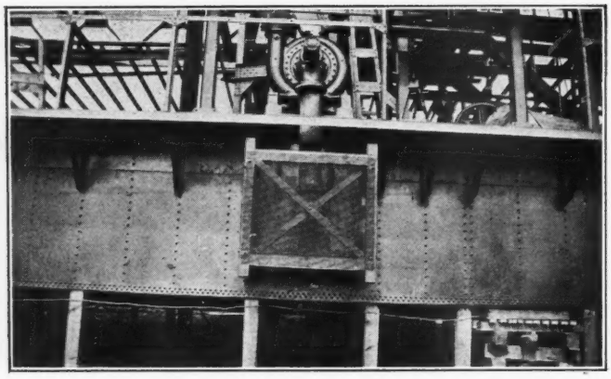
Power From Hydro-electric Plant

The only power company in the field was the Truckee General Electric Co., with hydro-electric plants on the Truckee River and a power-line system serving the Virginia City district. A five-year power contract was entered into with this company under the available schedules, which are subject to the supervision of the Nevada Public Service Commission. The maximum demand meter system operated in such a way as to cause some apprehension that power costs during operation might be as excessive as the power costs during construction had been. In March, 1920, power cost was approximately $180. In comparison, the cost for the kw.-yr. service in California would have been about $30. In June, construction power costs reached 5.2c. per kw.-hr. It was deduced that imposition of unusual loads such as lifting the upper tumbler or moving the dredge around the pit with the derrick caused a serious expense for power. An unusual load in June is estimated to have cost $65 for power alone. The maximum demand system, or Schedule K of the power company, was found to be especially severe for construction work, and an unsuccessful effort was made to have this class of work

placed under a schedule more consistent with the conditions peculiar to construction. An installation of a curve-drawing wattmeter was decided upon so that peak loads could be reduced to a minimum.

Re-used Material

Second-hand material available to the company was used wherever possible and was purchased wherever it was advantageous to do so. Corrugated iron, tools, canvas, lumber, furniture, safe, derrick and winch, air



SCREEN BOX FOR CENTRIFUGAL PUMP

tools and equipment, winch motors, cables, and compressors were gathered from various places. From Marigold, Cal., the dismantling of No. 3 dredge of the Marysville Dredging Co. afforded the following parts: main drive pinions, main drive pulley, screen, screen drive, stacker, stacker belt, electrical equipment, winches, operating gear, lower tumbler, ladder suspension, deck sheaves, spud and keeper, buckets; from No. 4 dredge: bull wheels, herringbone gears, bow-line drums, screen bars and plates for spares, ladder, upper tumbler, bucket line, stacker motor, stacker suspension, and gantry caps. Necessary repairs were made in this material at the shops of the Marysville Dredging Co. before shipping.

Design and Weight of Parts

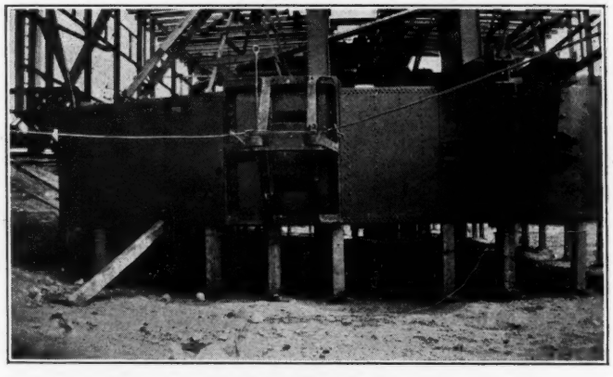
The dredge is of steel hull and steel superstructure design. The designs were worked out co-ordinating re-used parts with the new material in such a way as to result in a practically new dredge. Hull dimensions are 46 by 108 ft. 5 in. by 8 ft. deep, allowing a 20-in. freeboard under operating conditions. E. J. Watson prepared designs and plans for the dredge as a complete unit and supervised the work of repair at Marigold. Hull fabrication and construction in San Francisco were done by the Bethlehem Shipbuilding Corporation and Dyer Bros. Delivery of the hull material from the bottom up was provided for. Delay and difficulty ensued, owing to the fact that the work had to pass through the shops of two firms, but these difficulties were eventually overcome.

The estimated weight of the more important parts of the dredge are: hull, 323,825 lb.; superstructure, 201,634 lb.; house sheeting, 18,000 lb.; house roofing, 6,000 lb.; rivets, not included in foregoing, 5,000 lb.; total, 554,459 lb. As construction progressed, changes of various kinds suggested themselves, although no serious complications in conforming construction to design arose. Some of the changes in the hull were as follows:

Addition of a 6-in. angle iron under the bottom corners of the well hole for protection against interference of rocks when the ladder is being lifted; addition of 6-in. angle iron around corners of the bow and the curve for protection against rubbing of lines and swinging of dredge against side of pit; addition of plating on the bottom at the back of the well hole for protection if dredge is required to operate with insufficient flotation water; plating around the stern for protection against wearing of sand; setting the plates from the back of the well hole to the stern athwartships instead of longitudinally to provide for a break in the seam that would have extended from bow to stern; change from 8-ft. side plates (not to be had in reasonable time) to a built-up side plate, the joint being made by welding, and the seam slightly below the water line; longitudinal stiffening of the hull being provided for by two ½-in. plates, 8 ft. deep, running the length of the hull.

A novel feature in the construction of the hull was the use of arc welding for the deck seams and the upper side seams. All main construction joints were riveted as usual.

A number of minor changes in the designs were made, some on account of greater clearances and others for additional strengthening. Close attention was paid to the electrical installation, with a view to protecting motors and men against accident and for the purpose of gaining information to reduce as far as possible the power cost during operation. Trumbell externally operated switches in which contacts are covered by a steel casing were specified, and as the individual motor controls obtained from Marigold were not equipped with under- and over-voltage release attachments, it was decided to use an oil circuit breaker with under- and over-voltage relays on the main power circuit. A 4,500-volt oil circuit breaker was also mounted upon the the secondary side of the main substation for the protection of the 22,000-4,400-volt transformers. Arrangements were made to disconnect the dredge transformers by means of primary cut-outs. Instrument equipment included a curve drawing wattmeter to measure total



SPUD KEEPERS

load on motors, a portable voltmeter, and a switchboard ammeter to register the load on the variable speed motors.

Labor Drawn From Outside Localities

Local labor was scarce, and skilled labor experienced in dredge construction had to be drawn from outside localities, chiefly from California. At the outset, the question of wages came up for decision. The scale of wages had to be high enough as compared with existing labor scales in contiguous localities to hold the working

TABLE III. AGGREGATE MONEY INPUT BY MONTHS

		Total to Sept. 30, '19	Total to Oct. 31, '19	Total to Nov. 30, '19	Total to Dec. 31, '19	Total to Jan. 31, '20	Total to Feb. 29, '20	Total to Mar. 31, '20	Total to Apr. 30, '20	Total to May 31, '20	Total to June 30, '20	Total to July 31, '20	Total to Aug. 31, '20	Total to Sept. 30, '20	Total to Oct. 30, '20
A1	Design		$254.83	$1,341.10	$1,855.54	$2,229.97	$2,636.02	$2,937.17	$3,338.07	$3,438.84	$3,478.15	$3,317.90	$3,317.90	$3,317.90	$3,317.90
B	Superintendence	$300.00	600.00	900.00	1,200.00	1,500.00	1,900.00	2,300.00	2,700.00	3,100.00	3,500.00	3,900.00	4,300.00	4,700.00	4,753.00
C	Traveling expense	271.27	465.60	566.79	652.26	744.12	767.66	1,017.77	1,165.25	1,243.03	1,289.53	1,346.74	1,403.22	1,637.42	1,645.00
D	Boarding house operation	62.90	2.31	16.00	129.46	251.57	395.12	528.74	652.57	772.57	892.27	1,014.41	1,134.41	1,280.66	1,435.22
D_1	Boarding house and camp rents		55.00	115.00	181.20	236.20	291.20	351.20	401.20	421.20	408.20	403.20	408.20	408.20	418.20
D_2	Boarding house and camp improvements and furnishings		96.60	96.60	167.25	167.25	167.25	167.25	167.25	167.25	167.25	167.25	167.25	167.25	167.25
D_3	Boarding house and camp club house				74.74	186.77	282.76	285.94	305.52	269.32	254.89	233.83	208.33	188.83	199.81
E	Hull wages			10.00	45.48	186.79	507.32	3,230.16	7,995.80	11,447.10	13,754.23	16,009.20	16,865.94	17,514.44	18,231.24
F	Hull material			39.40	95.42	129.84	258.75	21,129.47	21,627.44	23,044.02	43,644.90	44,048.86	50,624.40	50,884.52	53,530.81
G	Machinery wages			7.25	42.67	42.67	187.21	439.44	813.51	2,186.38	4,659.50	7,255.32	10,766.40	12,218.20	12,986.89
H	Machinery material			34.12	166.02	972.99	1,004.14	7,432.15	7,529.84	9,291.01	9,291.01	10,422.49	11,964.90	12,313.31	92,619.14
I	Electrical wages			46.96				130.87	343.58	973.32	973.32	1,672.43	2,414.24	2,889.65	3,048.29
J	Electrical material							13.91	992.67	3,038.74	4,006.80	4,006.80	4,341.00	4,467.29	8,324.16
K	Freight							10,296.84	12,596.90	14,732.63	15,786.60	15,786.60	16,457.52	16,482.52	14,660.83
L	Power line and transformers		7.50	512.96	1,971.75	3,952.97	7,814.55	6,068.63	6,384.14	6,874.41	6,923.35	6,956.71	5,757.62	5,782.12	5,787.24
M	Miscellaneous		222.75	446.47	523.05	1,825.37	2,346.59	5,985.86	6,384.14	6,874.41	6,923.35	6,956.71	5,757.62	5,782.12	5,787.24
M_1	Temporary construction buildings						0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
M_2	Temporary construction equipment			183.76	597.27	609.57	609.57	609.57	609.57	609.57	609.57	609.57	609.57	609.57	891.03
N	Pit		1,340.66	2,386.67	212.06	298.96	560.44	888.37	968.01	1,014.69	1,051.15	1,054.48	1,054.48	1,130.98	1,378.64
O	Insurance (compensation)		87.32	166.54	3,743.52	3,991.73	4,615.07	4,615.07	4,616.43	4,616.43	4,616.43	4,605.43	4,605.43	4,605.43	4,605.43
P	Power				246.88	314.60	400.35	494.70	920.25	1,174.51	1,428.31	1,691.26	1,935.86	2,053.52	2,131.61
Q	Water supply							11.16	201.10	457.12	701.66	978.73	1,204.24	1,411.89	1,536.63
R	Roads		12.03		61.98		282.75	2,860.42	3,595.02	3,785.71	3,854.18	4,593.20	5,238.26	5,883.59	5,912.09
T	Tools		311.00	311.00	493.00		643.71	680.87	688.22	693.22	693.22	693.84	693.84	693.84	693.84
U	Derrick		35.15	126.08	238.54	544.14	1,527.55	1,959.46	2,591.31	2,849.16	3,045.05	3,209.78	3,365.33	3,449.60	3,264.46
V	Telephone line				590.03	1,148.16	1,769.65	2,067.72	2,154.58	2,231.83	2,306.83	2,381.83	2,436.83	2,745.94	3,245.54
W	Automobile			10.52	229.35	237.35	261.22	284.41	288.01	314.12	315.62	315.62	315.62	315.62	315.62
X	Hauling (includes switch and track)		1,340.66	2,386.67	3,743.52	3,991.73	4,615.07	4,615.07	4,616.43	4,616.43	4,616.43	4,605.43	4,605.43	4,605.43	4,605.43
			87.32	166.54	246.88	314.60	400.35	494.70	920.25	1,174.51	1,428.31	1,691.26	1,935.86	2,053.52	2,131.61
								11.16	201.10	457.12	701.66	978.73	1,204.24	1,411.89	1,536.63
			12.03		61.98		282.75	2,860.42	3,595.02	3,785.71	3,854.18	4,593.20	5,238.26	5,883.59	5,912.09
			311.00	311.00	493.00		643.71	680.87	688.22	693.22	693.22	693.84	693.84	693.84	693.84
			35.15	126.08	238.54	544.14	1,527.55	1,959.46	2,591.31	2,849.16	3,045.05	3,209.78	3,365.33	3,449.60	3,264.46
					590.03	1,148.16	1,769.65	2,067.72	2,154.58	2,231.83	2,306.83	2,381.83	2,436.83	2,745.94	3,245.54
				10.52	229.35	237.35	261.22	284.41	288.01	314.12	315.62	315.62	315.62	315.62	315.62
			1,892.91	1,950.63	1,975.07	1,885.79	1,898.14	1,899.33	1,917.59	1,950.54	1,909.36	2,059.73	2,109.05	1,846.32	1,850.57
			3,898.33	4,710.09	4,907.97	5,142.40	5,636.15	6,064.24	6,633.32	6,854.25	7,455.77	7,705.90	7,860.61	7,928.99	7,769.09
	Totals		$8,434.32	$11,829.63	$17,309.90	$23,334.18	$32,636.15	$45,364.03	$74,869.43	$91,989.47	$104,235.68	$137,308.99	$147,562.68	$162,892.08	$167,858.99	$255,737.60
	Number of men at end of month		6	9	10	15	17	17	35	38	36	39	40	29	29	
	Number of shifts worked during month		177	256.4	273.25	299.7	384.63	403.69	744.25	1,024.56	1,080.88	1,059.25	1,113.125	995.25	407½	273½
	Amount of payroll		$787.00	$1,190.49	$1,322.16	$1,547.86	$1,960.12	$2,156.48	$3,996.03	$5,529.27	$5,811.60	$5,801.40	$6,010.31	$5,591.05		
	Number of accidents		1	0	0	0	0	0	0	1	3	6	4	0		

Note—The alphabetical symbols suggest an easily understood and efficient account segregation.

organization together and low enough to secure a reasonable cost of construction. Throughout the construction work it was necessary to keep the flow of construction material and equipment such that there would be a minimum of interruption in the employment of skilled labor and a maximum of accomplishment.

In the beginning there were serious delays in the preparation of material, caused by the strike of shipyard employees at San Francisco. During this period the construction crew was kept busy on odds and ends, such as completing the railroad spur; unloading and erecting derrick; constructing temporary buildings at pit; completion of pit; installing dredge foundation; erecting and housing of construction transformers; completion of telephone line and ditch from Gold Canyon creek to pit; clearing of dredging area, and camp work generally.

The preliminary schedule of wages was $4 for labor and $6 for mechanics. A careful investigation of wage scales in use by the Marysville Dredging Co., the Valdor Dredging Co., Natomas, and the shipyards was made, and a tentative wage scale for construction and operation prepared. With some changes the scales were in effect during construction. They were as follows:

TABLE II. CONSTRUCTION WAGE SCALE

	Per Day		Per Day
Acetylene-torch operator	$5.00	Holders-on	$5.00
Blacksmith	6.00	Laborers	4.00
Blacksmith helper	4.50	Machinists	6.40
Boilermakers	6.40	Motormen	6.40
Carpenters	6.40	Oilers	4.25
Compressor storeman	5.00	Rivet heaters	4.50
Derrickman	5.50	Rivet passers	4.00
Electricians	6.40	Rigger foreman	6.00
Handymen	4.50	Truck driver (per month)	150.00 and board

The average of all wages for 7,812 shifts was $5.34 per shift.

Some friction developed as a reflex of the shipbuilders' strike in San Francisco, but it did not last long. In June, 1920, wages advanced in some of the dredging areas in California, and the company equalized its wage scales correspondingly when the dredge began to operate.

Labor input, together with segregation, is given in Table III. Table V gives the monthly force report, Table VI the machine service, and Table VII the power

TABLE IV. SUMMARY OF PRINCIPAL COST ITEMS

Design			$3,317.90
Superintendence and traveling			6,398.00
Boarding house and camp			2,220.48
Temporary construction and equipment			1,378.64
Telephone line			315.62
Roads			693.84
Pit			4,605.43
Water supply			5,912.09
Derrick			3,245.54
Transportation:			
Freight		$14,660.83	
Hauling		7,769.09	
Automobile		1,850.57	
			24,280.49
Power line and transformers			5,787.24
	Wages	Material	Total
Hull	$18,231.24	$53,530.81	$71,762.05
Machinery	12,986.89	92,619.14	105,606.03
Electrical	3,048.29	8,324.16	11,372.45
	$34,266.42	$154,474.11	$188,740.53
Insurance			2,131.61
Power			1,536.63
Total			$250,564.04

used and rivets driven. Costs are segregated into a number of separate accounts, and the aggregates of these accounts from month to month during the construction are given in the table, together with details of labor and payroll. A summary of principal cost items is given in Table IV.

On June 1, water was diverted from the flume of the water company and was turned into the pit June 3 at

8 a.m., rising sufficiently to float the dredge at 10:30 a.m. on June 8. On flotation, the draft at the bow was 25 in. and at the stern 37 in. Experiments had demonstrated that the pit softened on application of water, and the foundations were consequently increased in number to a degree unusual in other dredge-building operations. It is estimated that a load of 12 lb. per sq.in. was placed on the foundations of the eighty posts and five cribbings supporting the dredge. The performance of these supports was found entirely adequate, the dredge being supported in perfect alignment. After the dredge floated the blocking was dragged away by the truck and the water allowed to recede somewhat.

The dredge was practically completed during August, and was put into operation with appropriate ceremonies on Sept. 5, 1920. The theoretical capacity of the dredge was computed as follows:

$$\frac{20 \text{ buckets per m.} \times 9 \text{ cu. ft.} \times 60 \text{ min.} \times 24}{27} = 9{,}600 \text{ cu.yd.}$$

Estimating digging time at 80 per cent gives 7,860 cu.yd. as theoretical capacity. This theoretical capacity should be corrected for loss of operating time and the ease or difficulty of digging the ground.

In eight years of operation in the Yuba field, a dredge of the size described herein has handled from 5,800 to 6,600 cu.yd. per day. The capacity of the Gold Canyon dredge is expected to be much lower, on account of existing unfavorable conditions, such as the presence of boulders and the uneven contour of the bedrock surface. In 115.3 acres prospected, there are estimated to be 6,076,000 cu.yd. of gravel, which will require more than four years of operation.

TABLE V. MONTHLY FORCE REPORT BY SHIFTS

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
Foreman	31	30	31	30	31	31	30	31	30	275
Blacksmiths	31	22	31	30	29½	29	6	....	....	178½
Blacksmith's helpers	31	30	31	30	30	31	5½	....	....	188½
Boilermakers	92	110	114	86½	66	61	31½	9	....	569½
Carpenters	41	84	91	115½	99½	89	87½	102½	94½	804½
Storeroom man	31	31	31	29½	30	31	13½	....	....	196½
Derrick man	25	30	31	30	30	26	....	....	....	172
Handy men	229	348	326	281½	314½	307½	158½	120½	30	2,115½
Watchman	....	....	....	28	31	31	4	....	....	94
Laborers	144	190	224	226½	267	201½	31½	....	38	1,322½
Riggers	31	26	31	30	30	6	....	....	....	154
Truck drivers	31	30	31	30	31	31	5	....	....	189
Electricians	....	15	55	56	61	62	35½	11	22½	317½
Electric welders	....	44	22	....	....	....	....	....	....	66
Office	....	30	31	....	....	....	....	....	....	61
Totals	717	1,020	1,080	1,003½	1,051½	937½	407½	273½	215.125	6,704.375

TABLE VI. MACHINE SERVICE

	March	April	May	June	July	Aug.	Sept.	Total
Hours caulking hammer used	181½	193	390	43	....	....	..	807.5
Hours riveting hammers used	472½	659	459	262	96	22	..	1,970.5
Hours pneumatic drills used	124½	351	328	674	550	71	..	2,098.5
Hours welding machines used	....	159	....	...	....	....	..	159
Hours automobile used	33	54	66	82	76	106	92	509
Hours truck used	125½	90½	137½	92½	70	89½	62	667.5
Hours oxy-acetylene torch used	6	21	49	101	83	122	18	400
Hours 10x10 compressor used (35-hp.)	166½	238	244	230	236	117	..	1,231.5
Hours 8x8 compressor used (15-hp.)	12	184	101	56	....	111	48	494
Hours derrick used (50-hp.)	91	69	129	121	131	87	..	628
Hours shop motor used (1-hp.)	38	50½	129½	136	139½	127	17	637.5

TABLE VII. POWER USED—RIVETS DRIVEN

	Maximum Power Demand, Kw.	Power Factor, Per Cent	Total Kw.-Hr. Used	Rivets Driven	Rivets per Day
March	64	70	2,825	12,341	588
April	72	74	8,275	26,323	877
May	74	74	6,825	9,727	314
June	100	76	5,300	3,277	164
July	76	66	3,775	1,015	...
August	72	71	3,100	294	...
September	57.4	84	850	.....	...
Totals	73.6	73.5	30,950	52,977	..

South African Mineral Production

The mineral production of the Union of South Africa for 1919 and 1920, compiled from returns prepared by the Government Mining Engineer and subject to revision, are given in the following table:

Metal, Mineral, or Precious Stone	1919 Quantity, Fine Ounces	1919 Value, £	1920 Quantity, Fine Ounces	1920 Value, £
Gold	8,331,651	35,390,609	8,158,455	34,654,922
Silver	891,304	203,646	892,205	224,769
	Carats		Carats	
Diamonds	2,592,099	11,237,778	2,551,665	14,762,956
	Tons		Tons	
Coal	10,261,859	3,430,361	11,473,452	4,506,572
Copper	4,904	( ) 208,902	(b) 10,875	(b) 445,007
Tin	1,629	(a) 275,111	(c) 2,451	(c) 446,284
Antimony	32	556	.....	.....
Arsenic	8	663	11	655
Asbestos	3,934	66,426	7,112	114,195
Bismuth ore	.....	300	.....	.....
Corundum	179	1,486	261	1,446
Graphite	86	2,630	73	2,339
Iron ore	3,602	1,081	2,564	811
Iron pyrite	5,532	8,894	3,469	5,014
Lead ore	756	4,973	587	5,787
Magnesite	1,024	2,723	1,419	3,780
Manganese ore	155	776	67	277
Mica	3	369	1	500
Mineral paints (iron oxide, ochers, etc.)	240	572	536	1,049
Soda	52	753	.....	.....
Talc	757	2,170	682	2,227
Tungsten	4	626	.....	.....
Zinc	.....	.....	(b) 2,349	(b) 15,614
Totals	.....	50,841,405	.....	55,194,204

(a) The value given is calculated on the percentage of pure metal content at London quotations. (b) Ore and concentrates. (c) Concentrates and metallic tin.

Among commodities of lesser importance, copper, tin, and asbestos reflect increased production and values, the expansion of the asbestos industry being especially noticeable.

Another Important Copper Producer

In the May 14 issue of *Engineering and Mining Journal*, on p. 848, we published a list of seventy-nine of the principal American copper-producing companies. Through inadvertence, we failed to include the name of the El Tiro Leasing Co., operating at Silverbell, Pima County, Ariz. This company, though now shut down through lack of smelting facilities and the low price of copper, produced about three million pounds of copper in 1920, and expects, when market conditions improve, to ship at least 600,000 lb. of copper per month from oxidized ores averaging 7 per cent copper. There is no mill. The ore is smelted by the American Smelting & Refining Co. at El Paso or Hayden, refined by the same company at Baltimore or Maurer, N. J., and sold by the A. S. & R. through its New York headquarters.

The Future of Small-Scale Mining and Smelting In Chile

Transportation Problem, High Costs and the Exhaustion of Deposits Responsible for Decline of Custom Smelters—Opportunity for Small Furnaces Situated Near Rail—Main Cordillera Almost Virgin Territory

BY WALTER STRACHE
Written for *Engineering and Mining Journal*

CHILE, which has been aptly termed the land of ten thousand mines, is feeling the effects of demoralized metal markets perhaps more keenly than other countries where developed industries or the extensive prosecution of public works absorb part of the unemployed. The situation is aggravated by the dull state of nitrates. Formerly, during temporary slumps in metal mining, labor migrated north, feeling fairly certain of employment in the *pampas*, where up to twelve or eighteen months ago there was generally a dearth of men. Today, however, with the demand for nitrates limited, owing to a low exchange in countries which were formerly great consumers, as well as to the manufacture of the synthetic salt in others, many of the plants are compelled to close down. The southern part of the country is largely agricultural, and the demand for labor is well supplied by the non-migratory type. The poor miner is therefore fallen on lean days. Fortunately, the government is alive to the situation and does much to prevent actual suffering. One railroad project is already under construction, namely, the 110-km. line from Iquique to Pintados, and the others under consideration will likewise help to alleviate the situation.

CHILE THIRD IN COPPER PRODUCTION

Copper mining and smelting and lixiviation enterprises form the principal metal industries, and in recent years Chile reached and held third place in the list of the world's great copper producers, being led by the United States and Japan. In 1920 exports of the metal totaled 98,200 tons. Of this tonnage, however, over 83 per cent is credited to Chuquicamata and Teniente (Braden) and the rest to bar and matte production from six smelters. It is significant that the production from small properties tributary to custom smelters is steadily decreasing except in some isolated instances. A glance at the diminishing number of smelters demonstrates this pointedly. In 1916, eighteen establishments were listed in the government statistics; in 1918, when copper sold for 24 or 25c. per lb., six had suspended operations, and in 1920 the list was shortened by six more. At the present time, which, however, is hardly a criterion, only the smelters at Naltagua and Chagres are working; Chuquicamata and Teniente are working only part time, and Potrerillos shut down altogether in December, 1920. The latter, though, had not yet reached the producing stage.

HIGH COSTS, EXHAUSTION OF DEPOSITS, AND HIGH TRANSPORTATION COSTS CAUSE DECLINE

The causes of the decline in production of the custom smelters and the yearly decrease in the number of these are mainly the following:

1—The high costs in 1919 and 1920 of all food staples, steel, explosives and other supplies, without compensating increases in prices offered by the smelters when New York quotations were between 18 and 15c. per lb. This rendered impossible the operation of many of the innumerable small properties whose collective output furnished the bulk of the smelters' requirements.

2—Exhaustion of some of the formerly producing mines and the non-productive state of others due to neglect to control water or to adopt other precautions.

3—The transportation problem. Except in rare instances where the production is desirable, as in the case of high-grade copper-bearing fluxes, ores are bought f.o.b. smelter. The grades on which the producer can afford to pay pack-animal freight to the railroad, handling, and railroad charges to the smelter are in direct ratio to the distance from the mine to the smelter. Consequently, although there are several districts capable of furnishing considerable tonnages of 5 to 8 per cent ores, the prices offered for such grades do not warrant production.

These conditions do not necessarily mean that eventually custom smelting will be a memory in Chile and that production will be limited to Chuquicamata, Teniente, and later Potrerillos. It must be emphasized that many of the smelters that have shut down were built from ten to twenty or more years ago, and it is a logical conclusion that sooner or later some of the mining districts tributary to such smelters must have become totally or at least partly exhausted. With a high copper market, smelters on the coast augmented their ore receipts by marine shipments via Antofagasta from points as far north as Bolivia. But with a price to which copper quotations have now fallen the margin on smelting will not admit paying extraneous freights, with the possible exception of some of the silver-bearing Huanchaca ores.

Two ways are open to revive custom smelting and consequently stimulate production: (*a*) Small-scale smelting in districts where development is retarded by excessive transport costs; (*b*) systematic prospecting in the higher Cordillera.

FREIGHT PROBLEM GREATEST DETERRENT TO SMALL-SCALE OPERATIONS

Today the freight problem is, and it probably will always be, the most serious deterrent to the development of districts capable of furnishing 2,000 tons or more monthly of 5 to 8 per cent ores, generally with 2 or 3 oz. of silver, but too distantly located by trail or rail from the custom smelters. The richer ores were shipped in years past, and what remains on the dumps and in the mines, although often fair smelting material, can command no price, because of the freights. A furnace situated in the center of such a district obviously would not pay, on account of the same factor on coal and coke or matte.

A characteristic of Chile is its extreme length in pro-

portion to its width. The Longitudinal Railroad, a line over 3,000 km. long, roughly parallels the coast at distances of from 60 to 70 km., and the mining districts, with the exception of Chuquicamata, Teniente, and Potrerillos, which own their own lines, and a few of the higher-grade properties, are generally situated within 25 to 40 km. of the rails. If, in addition to pack-animal freight, the operator is compelled to pay railroad charges for a 150 to 200-km. haul to the nearest smelter, he is naturally limited as to his shipping grades.

It would appear that furnaces of from 100- to 125-ton daily capacity situated at or near the rails and within easy distances of such districts would have no difficulty in obtaining ores up to 8 per cent and would be in a favored position to compete for the production of the higher grades. This would not cut heavily into whatever lots the larger smelters formerly acquired, but would probably effect the sales of 20 to 25 per cent export ores.

Enterprises of this kind must naturally assure themselves of a sustained production over a period of years, and must work with low overhead charges. With reverberatory furnaces using pulverized Chilean coal, a manager who can discharge the duties of ore buyer, a good smelterman, chemist, and bookkeeper it is probable that in a period of uninterrupted running a small smelter would show more profits than the larger ones with costly organizations and extremely high overhead.

Cordillera Proper Mainly Virgin Territory

The zone within 40 to 50 km. of the coast has been gone over since the days of the Spanish invasion in the middle of the sixteenth century, when Almagro, Monroy, and Valdivia, coming from Peru, overran the country in quest of gold. Much later Chile entered the lists of great copper producers, and exports in the ten years from 1910 to 1920 showed a steady increase from 38,232 to 98,200 metric tons. Until recent years the greater part of this was produced in this zone, and here American and foreign engineers examined, during the last five or six years, practically every producing property, prospect, or *antigua* for coast smelters or private interests. Further inland or in the "near" Cordillera several deposits of 2 to 4 per cent disseminated ores with possible tonnages up to two million are known of generally by all local operators. As a rule, however, absence of indications warranting exploration for greater tonnages has retarded development.

The Cordillera proper, on the other hand, is in the main virgin territory. The hardships of desert travel with pack animals where water is often lacking for months have deterred the prospector from coming to this arid, wind-swept region. Little geological work has been done by the Chilean government in that part of the country near the international line, and the geological data extant are too scant or antiquated to be of value. It is noteworthy that the "big three," namely Chuquicamata, Teniente, and Potrerillos, are all in the higher altitudes. This in itself proves nothing; but it should certainly stimulate closer study of the more inaccessible regions than they have been accorded heretofore.

A well-organized party headed by an engineer with a balanced sense of business possibilities would not suffer unduly if properly financed. Food, fodder, and, where necessary, water depots can be established before the actual field work begins. The season's work of six months can be limited to a close geological mapping of a limited area. Such work, intelligently conducted, would not only cover the field of prospecting, but would gain for those interested an invaluable first-hand knowledge of the country, with its present or future possibilities. Incidentally, it would do much in running down some of the alluring stories of wonderful deposits which are so current in certain localities.

Chilean Miner Competent and Hard Working

As all mining enterprises are so interwoven with the labor question, a word may be said for the Chilean miner. During my travels in the hills in the course of examining hundreds of large and small properties and prospects I have invariably found him competent and hard working, generally with no regard for hours; and this at times under the most primitive of mining conditions underground and elemental living conditions above. In some districts meat is an almost unknown luxury, the menu consisting of an unvarying monotony of *porotos*, or beans, which, although of high nutritive value, would pall on the palate of the ordinary miner. In small mines, a few shacks form the camp, or the native miner makes his home for the time being in a windy adit. Yet withal, he is content, and what impresses the foreigner especially is his solicitude for the education of his children. Another characteristic is his unfailing courtesy, loyalty to his *patron*, and, above all, a true miner's faith in the ultimate richness of the vein. *"Hay que profundisar un poco mas"* (You only have to go a little deeper").

Platinum Production Decreased in 1920

Estimates of the production of crude placer platinum in the United States in 1920 give Alaska, 27 oz.; California, 656 oz.; Oregon, 23 oz.; and Washington, 8 oz., according to the U. S. Geological Survey.

Refiners reported a production of 41,544 troy ounces of new platinum metals in 1920, of which 36,015 oz. was platinum, 418 oz. iridium, 409 oz. osmiridium, 4,309 oz. palladium, and 393 oz. of the minor metals, including rhodium and osmium. This represents a decrease of 3,565 oz., as compared with the production in 1919.

There were also produced 57,710 oz. of secondary platinum metals in 1920, of which 51,255 oz. was platinum, 3,355 oz. iridium, and 3,100 oz. palladium. This represents a decrease of 3,806 oz., as compared with the production in 1919.

The platinum metals imported for consumption in 1920 included 80,955 oz. of crude platinum and unmanufactured ingots, bars, sheets, and other forms, of which approximately 58,009 oz. is believed to be refined metal; 4,718 oz. of iridium; 4,473 oz. of osmiridium; 6,944 oz. of palladium; 2,675 oz. of the minor metals; and 781 oz. of manufactured platinum ware. The imports of platinum for consumption in 1920 were 32,492 oz. greater than in 1919.

The consumption of platinum metals in the United States in 1920 was 141,041 oz., of which the jewelers took 57 per cent, the electrical industry 19 per cent, the dental industry 11 per cent, the chemical industry 10 per cent, and miscellaneous uses 3 per cent.

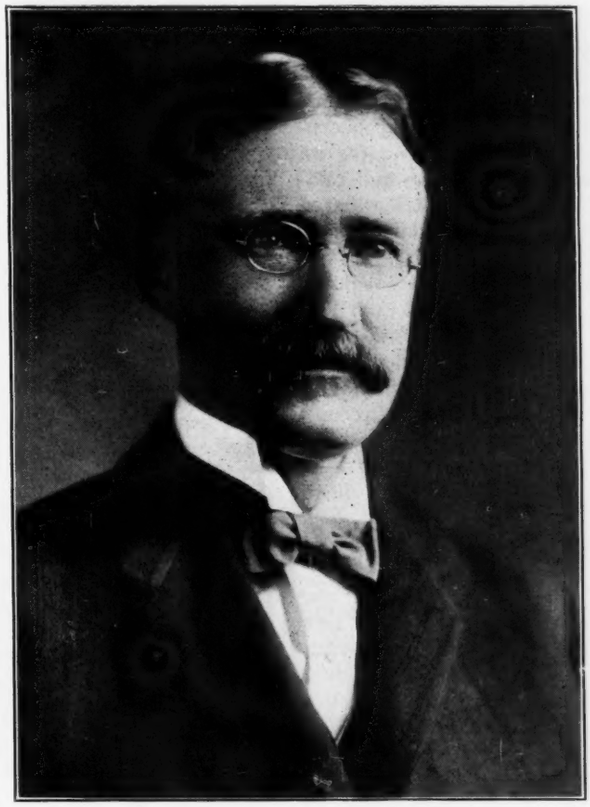
The stocks of platinum metals at the end of 1920 amounted to 67,508 oz., which is an increase of 55 per cent as compared with the stocks that were on hand at the end of 1919.

Geologists of Note

Frederick Leslie Ransome

FREDERICK LESLIE RANSOME was born in Greenwich, England, on Dec. 2, 1868. His father, in 1870, went to California, with the expectation of returning to England, but decided to remain, and was joined by his wife, son and a younger daughter. Six additional children were born in the United States, and the elder Ransome became an American citizen. F. L. Ransome attended the public schools of San Francisco and Oakland, studying under Le Conte and Lawson, and was graduated from the University of California in 1893. After graduation, Ransome gained a teaching fellowship, and in 1896 obtained a Ph.D., having published four papers on the geology of California, and assisted H. W. Turner in field work for the U. S. Geological Survey in the Sierra Nevada. In 1896, in San Francisco, Mr. Ransome took the first civil-service examination held for appointment to the scientific staff of the U. S. Geological Survey, and on the same date two men with whom he was later associated, George Otis Smith and Arthur C. Spencer, struggled with the same examination in Baltimore. The three stood at the head of the list of contestants. While awaiting an opening on the Survey, Mr. Ransome accepted an assistantship at Harvard University, where he taught mineralogy and petrography. In 1897 he succeeded C. W. Purington as assistant to Dr. George F. Becker, of the U. S. Geological Survey, and has ever since been identified with the Survey's geological work. His major official publications, familiar to mining engineers, include reports on the Mother Lode, Silverton, Rico, Cripple Creek (with Waldemar Lindgren), Breckenridge, Globe, Bisbee, Ray, Miami, Cœur d'Alene (with F. C. Calkins), and Goldfield and Bullfrog districts (the last with G. H. Garry and W. H. Emmons). Since 1915 he has been chief of the section of Geology of Metalliferous Deposits, of the Survey, succeeding Waldemar Lindgren in that position.

When, at the suggestion of J. E. Spurr, the journal *Economic Geology* was founded in 1905, Mr. Ransome was active in its organization, and he has continued on its editorial board. He was on the first editorial board of the *Proceedings of the Washington Academy of Sciences*, is an associate editor of the *American Journal of Science*, one of three representatives of the National Research Council on the editorial board of the *Proceedings of the National Academy of Sciences*, and on the editorial board for the new series of scientific publications of the National Geographic Society. In 1914, in recognition of his services to science, Mr. Ransome was elected to membership in the National Academy of Sciences, and in 1918 was made treasurer of the academy and of the National Research Council. He is a member of the Washington Academy of Sciences and was its president in 1919; a fellow of the Geological Society of America and the American Association for the Advancement of Science; a member of the A. I. M. E., the Society of Economic Geologists, and the Geological Society of Washington (of which he was president in 1918). He was a charter member of the Mining and Metallurgical Society. In 1906 he attended, as a delegate of the U. S. Government, the International Geological Congress held in Mexico, and in a similar capacity in 1913, the twelfth session of the same congress in Canada. In 1918 he served with the late Hennen Jennings, J. H. Mackenzie, Charles Janin, and H. D. McCaskey on a committee appointed by the late ex-Secretary Franklin K. Lane, to investigate the gold-mining situation in the United States. He married, in 1899, Amy Cordova Rock, of Washington, and they have three daughters and one son. As might be expected of a geologist, Mr. Ransome is a lover of out-door life. He and his family spend their summer vacations cruising on the lower Potomac in a power boat of his own building. In his geological work Ransome seldom indulges in speculative flights of the imagination. Preferring to devote himself to the science of geology rather than to engineering or statistical studies, he has refused to acknowledge any real distinction between pure science and applied science, and has held that economic geology affords as many opportunities for thoroughly scientific investigation as do those branches of geology whose connection with industry is less apparent.



FREDERICK LESLIE RANSOME

CONSULTATION

Manifold Uses of Quartz

"I am interested in the uses of quartz, but am unable to obtain any information which gives all the data I require in one particular reference. Will you kindly inform we what the principal uses of quartz are, and where I can get detailed information?"

Quartz occurs so widely distributed and in such a variety of forms—sand, gravel, sandstone, quartzite, novaculite, flint, chert, pegmatitic masses, quartz veins, and other varieties—that definite information concerning its occurrence and distribution would require an extended treatise. Besides these more massive and relatively pure forms, quartz is abundant in disseminated grains as a constituent of granite, gneiss, mica schist, and other less common rocks.

The uses and markets for this mineral are equally varied, if not more so. Much sandstone and quartzite are quarried and used as stone, either in massive block form, or crushed for concrete, railway ballast, road metal, and other purposes. At the opposite extreme is the clear, colorless quartz, perfectly transparent and free from flaws, used in the manufacture of lenses and other optical appliances, and, when cut in the form of brilliants, as a substitute for diamonds in cheap jewelry. This variety is known as rock crystal. The colored varieties used in jewelry (some of them furnishing gems of high value) include amethyst, smoky quartz (cairngorm), citrine (false topaz), aventurine, prase, cat's eye, tiger eye, rose quartz, and other less common varieties. If chalcedony be included with quartz, the ornamental varieties of agate, carnelian, sard, onyx, sardonyx, chrysoprase, plasma, and heliotrope or bloodstone are added to the list.

Natural quartz sand and crushed sandstone, quartzite, novaculite, pegmatitic quartz, and vein quartz are applicable to numerous uses, some of the most important being glass sand, molding sand, building sand, filter sand, sand for common brick and for sand-lime brick, sand-blast material, and sand paper. Finely pulverized, it enters into the body and the glaze of pottery, and is used as wood filler, paint pigment, polishing material, as an ingredient of scouring soaps and dentifrices, and as a filler in fertilizers. Grindstones for metals and for wood pulp (called pulpstones) are made of sandstone; and some millstones are made of conglomerate and of silicified limestone (burrstones).

Quartz in any of its natural forms is used as a flux in smelting basic ores, and purer varieties are employed in the electric furnace in the manufacture of ferrosilicon alloys and fused quartz glassware. There are also many minor uses for quartz, and the compilation of a complete catalog would be difficult to gather satisfactorily.

Obviously, the requirements as to purity, crystallization, transparency, size and form of grains or fragments and other characteristics vary greatly according to the purposes for which the material is to be used. Glass sand, for example, must possess a high degree of purity. Only minute amounts of iron, alumina, and titanium can be tolerated. Building sand, on the other hand, may be distinctly stained, but the shape of the grains is important. In both natural sand and the crushed materials the size of the grains and the degree to which they must be screened to uniform size varies according to the use to which the various grades of the material are to be put.

Statistics and information as to the occurrence, production, and uses of quartz are gathered and published annually by the U. S. Geological Survey, Washington, D. C., but these are incomplete, and, like most other Government publications, are generally several years behind time. The unsatisfactory nature of the information is due largely to the fact that there are great numbers of small producers, many of them operating irregularly, and to the unwillingness of many of them to furnish the data requested. They do not know, or have not been fully convinced, that such information is held in strict confidence, and that only the totals are given out. It is also not so generally known as it should be that such co-operation with the Survey, besides increasing the accuracy and value of the statistics, may be the means of direct assistance to the individual producer. In answer to numerous inquiries the Survey is often able to bring producer and consumer together, to their mutual benefit, a function which the Survey is glad to exercise.

The available information about quartz in the annual volume on *Mineral Resources*, published by the U. S. Geological Survey, is scattered through several chapters, each of which may be had in separate form, as follows: Gems and Precious Stones; Silica; Sand and Gravel; Sand-Lime Brick; Abrasive Materials; Stone. Among the available state reports may be mentioned "The Glass Sand Industry of New Jersey," (address, State Geologist, Trenton); "The Sand and Gravel Resources of Missouri," (State Geologist, Rolla); "Glass Sands of Kentucky," (State Geologist, Frankfort); "Sand and Gravel Deposits of Georgia," (State Geologist, Atlanta); "Glass Manufacture and the Glass Sand Industry of Pennsylvania," (State Geologist, Harrisburg). Many states have also published reports on building stones.

Two Most Important Sulphur Producers

"Will you kindly tell me what are the most important sulphur mines in the United States?"

The two largest producers of sulphur in the United States are the Union Sulphur Co., whose mine is at Sulphur, Calcasieu Parish, La., and the Freeport Sulphur Co., whose mine is near Freeport, Brazoria County, Tex. These two companies furnish about 99 per cent of the sulphur produced in the United States. It would be well for you to obtain a copy of a brochure called "Sulphur and Pyrites in 1918 and 1919," published by the U. S. Geological Survey, Washington, D. C., as it contains additional information. The pamphlet is mailed free upon application to interested persons.

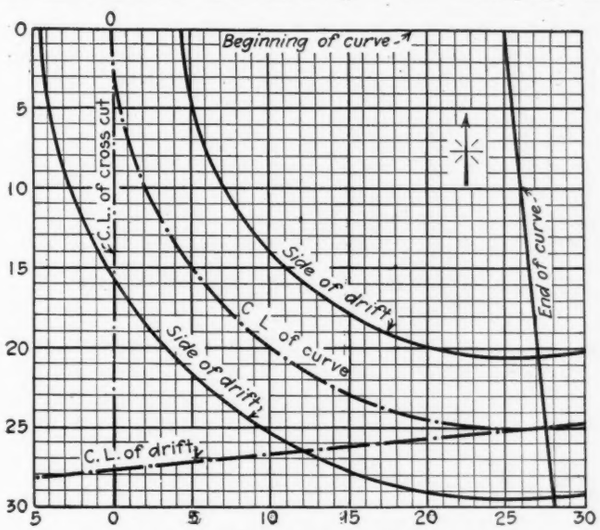
HANDY KNOWLEDGE

A Curve Chart for Drift Work

BY B. G. BEST

Written for *Engineering and Mining Journal*

The accompanying curve chart I have used with success in rock drifts where no timber is placed. Near the point at which the curve is to begin, the center line of the crosscut is established by two or more plugs in



A CURVE CHART FOR UNTIMBERED DRIFTS

the back of the crosscut, after which the captain is given the distance to the point of curve, the curve chart, and an instruction sheet reading as follows:

The scale of this drawing is 5 ft. to 1 in., and the smaller squares represent 1 ft. Everything is laid out with reference to the center line of the crosscut, which is represented by the vertical line marked 0—0. The vertical lines to the right of this line marked 5, 10, 15 and so on, are 5, 10 and 15 ft. east of the center line of the crosscut. The horizontal lines represent distances south of the point where the curve began. For instance, to locate the center line of the curve 10 ft. south of the point of beginning, follow down the 0 line, or center line of the crosscut, until it is intersected by the horizontal line marked 10. Then follow east on this horizontal line until it intersects the line marked center line of curve. This point of intersection is two squares to the right of the 0 line, or 2 ft. east of the center line of the crosscut.

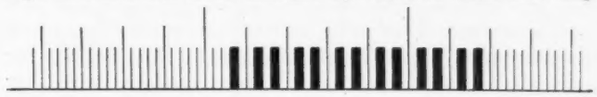
Metric Scale for Surveyors

BY J. S. CARNAHAN

Written for *Engineering and Mining Journal*

A part of a metric scale for surveyors, divided in the usual manner, five divisions to the meter, each representing 20 cm., is illustrated in the accompanying sketch. On the 1:500, which is the scale most in use for mine mapping, the divisions are of shorter length than on any of the others. They are so fine as to produce eyestrain in a comparatively short time, and become indistinguishable as one grows older. The inking in of the second and fourth divisions of each meter, as shown in the sketch, throws all five into brilliant relief, minimizes the eye strain and facilitates generally the use of this most important of metric scales.

Similar treatment of other scales will probably be worth while. A flat beveled scale blade, rather than a triangular prism, is recommended, because the ink shadings are less liable to erasure by contact with the map



INKING SECOND AND FOURTH DIVISIONS OF METRIC SCALE AVERTS EYE STRAIN

or other surface. A white enameled scale edge is preferable to the yellow. At the extremities of the meter divisions, the adjoining subdivisions are both white, but they are easily distinguished, one from the other, by the extra length of the line dividing them. This break in the alternation of black and white divisions facilitates, in reality, the use of the scale.

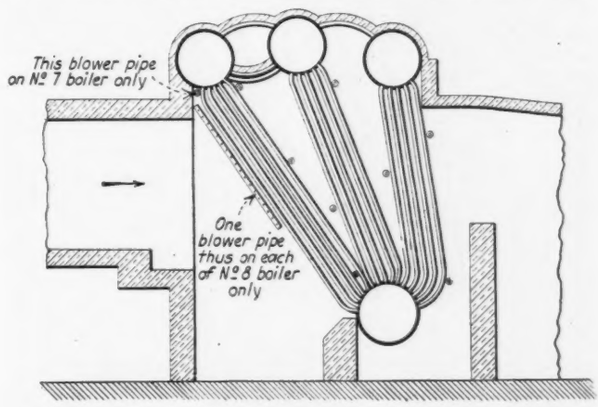
Soot Blowers on Waste-Heat Boiler

BY N. L. STEWART

Written for *Engineering and Mining Journal*

During the last year experiments have been carried on with Diamond soot blowers on the two waste-heat boilers of one of the reverberatory furnaces at the Garfield smelter. These blowers could more properly be called dust or slag blowers, as the flue dust on the front row of tubes is quite often fused into a sticky mass. The blowers are operated with steam at about 150 lb. The two boilers are Stirling, Class S-17, set in battery.

The blowers on the first trial gave fairly good results on the back tubes, but failed to clean the front tubes.



BLOWER PIPES KEEP TUBES CLEANER THAN WITH HAND BLOWING

It was then decided to change the position of the front blowing units, but to try one arrangement on No. 7 boiler and a different arrangement on No. 8. On No. 7 boiler the front blower pipe was placed in a horizontal position almost directly under the center of the upper front drum. The steam jets, therefore, in this test were parallel to the boiler tubes. This arrangement gave good results.

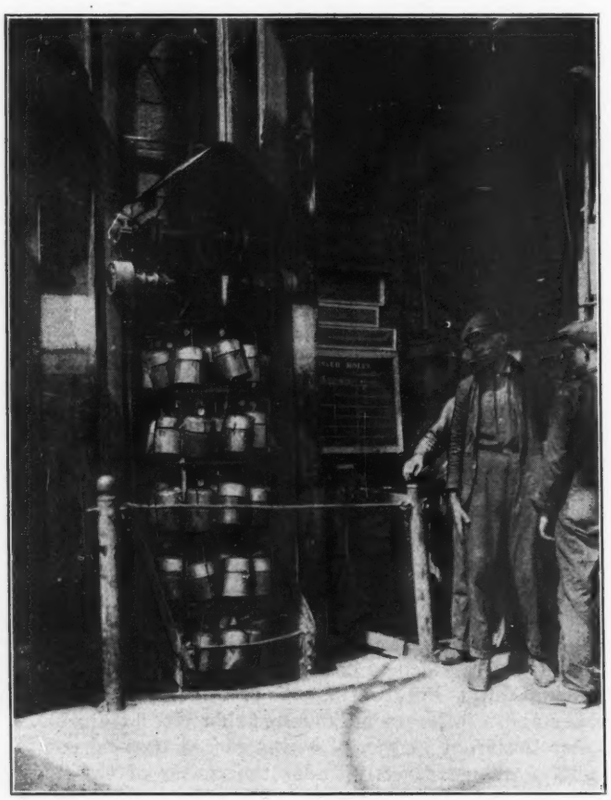
On No. 8 boiler two blower pipes were provided, placed parallel to the front boiler tubes and in recesses in the side walls of the brick setting. This arrangement gave poor results. The boiler tubes were not cleaned nearly as well as on No. 7 boiler. Furthermore, the steam jets blowing across the boiler tubes cut grooves in them, and several tubes had to be replaced. As the blower pipes could not be moved while the reverberatory was in service, the use of the front blowers on No. 8 boiler was discontinued for the remainder of the run. As the single horizontal blower gave such good results on No. 7 boiler it is probable that this arrangement will be adopted on any other boilers that may be equipped with soot blowers.

In general, if the soot blowers continue to operate satisfactorily, they will effect a saving by keeping the tubes cleaner than with hand blowing, and by admitting less cold air to the boiler. The soot blower has been operated so far about every six hours. The time the steam of any one blower pipe is actually on probably averages about thirty seconds. It is practically impossible to measure the quantity of steam used in blowing and to determine the exact saving. The placing of the soot blowers is shown in the accompanying sketch.

Handling Lunch Buckets

Written for *Engineering and Mining Journal*

At the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., lunch buckets, instead of being piled into a skip or cage, are hung from a frame which is suspended by hooks in the timber skip. The buckets, each with its identification tag, are hung from hooks attached to rings, which are placed on the frame a sufficient distance apart to allow the bucket to swing clear. About eight buckets are suspended from each horizontal circle. The frame revolves readily about its suspension. The lunch bucket trip is stopped at each level, and the miners take off their buckets.

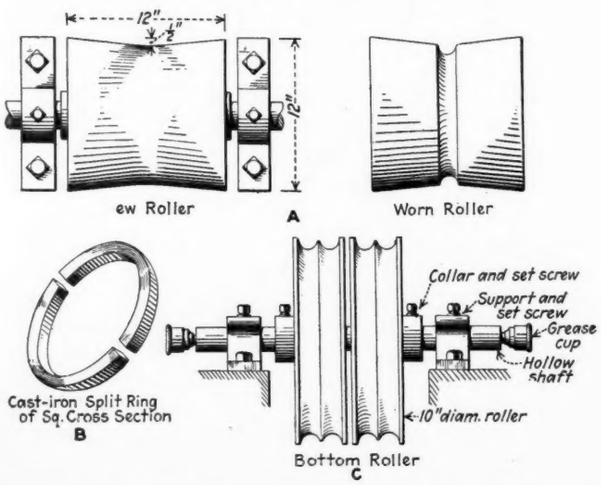


LOWERING A LOAD OF LUNCH BUCKETS AT PLYMOUTH MINE

Shaft Rollers

Written for *Engineering and Mining Journal*

In inclined shafts, the hoisting rope is carried upon rollers or idlers. Where a vertical shaft departs from the vertical and becomes an incline, top rollers, or rollers placed upon the hanging-wall side of the shaft compartment, are necessary to prevent the shaft timbers from being cut by the rope and to reduce the friction of the rope to a minimum. The main shaft of the Plymouth Consolidated Gold Mines, Ltd., Plymouth, Cal., is vertical to the 1,600 level. It then passes to a 55-deg. incline, the transition curve being of 250-ft. radius.



SHAFT ROLLERS USED AT PLYMOUTH MINE

Between the 2,100 and 2,300 levels the shaft steepens to 60 deg. and then to 65 deg. and finally in its lower portion flattens to 50 deg. The total vertical depth to the 3,235 level is 3,000 ft. With these changes of angle, rollers are necessary at several points and bottom rollers in the inclined section of the shaft. Top rollers are made of cast iron and turn upon a stationary shaft. The surface of the roller is made concave, the concavity being approximately ½ in. The roller is hollow and partly filled with crude oil through plugs which are screwed into its ends. A bushing is used and oil holes connect with the oil space within the roller. The shaft ends are supported by boxes bolted to the timbers.

The bottom roller consists of a pair of double-grooved wheels which turn upon a shaft. Two collars are set upon the shaft and are adjustable so as to allow of a small amount of end-play. Two boxes with setscrews support the shaft. Lubrication is provided by making the shaft hollow and putting grease cups in both ends, as shown at *C* in the figure.

The top rollers wear as shown at *A*. When badly worn the roller is replaced and the worn roller repaired by turning down a split cast-iron ring, shown at *B*, until it can be driven into the groove. The roller is turned down until the surface is smooth and is ready to be used again. Both types of rollers give excellent service and were devised and made at the mine shops. The maximum speed of hoisting is 1,000 ft. per minute.

THE PETROLEUM INDUSTRY

Draining Oil Reservoirs by Shafts and Tunnels

BY PAUL DE CHAMBRIER*
Written for *Engineering and Mining Journal*

THE MINING of shallow oil sands by shafts and tunnels at depths from 10 meters to 65 meters was applied in Alsace from 1735 to 1865. From that time on the mining works were deepened to 72 and 95 meters and then abandoned in 1888. During the first phase, the production consisted in raising bituminous sand to the surface and washing it with boiling water in order to draw 30 to 50 kg. of thick grease out of each ton of sand. The layers developed during the second phase from 1865 to 1888 were richer. A heavy crude oil of 0.985 specific gravity, 12 deg. Bé., containing neither gasoline nor kerosene, oozed naturally and was collected in a sump, from which it was taken out of the shaft.

By boring in oil sands situated at a depth from 150 to 450 meters flowing wells were struck which yielded light crude oil of a specific gravity of 0.870, 31 deg. Bé. The subterranean works were then abandoned. Mining works were only begun again during the war, in the year 1916, on quite a new principle. The question was now to drive tunnels in a layer saturated with gas, a very dangerous operation. This audacious test, tried in the Pechelbronn mines, was perfectly successful and established that this extracting method was fitted to recover quantities of oil two to five times greater than those already obtained from the same bed by the boring process.

Seth S. Langley, in the Dec. 4 issue of *Engineering and Mining Journal*, expounds a method for determining certain production estimates and the calculation of drainage area of oil sands. He presents an example of pay sands with 3 per cent oil extractable by borings and by drainage tunnels.

In Alsace the practical result has been more favorable. From one ton of oil sands, 20 kg., or 44 lb., of oil is extracted by wells and after this about 50 kg., or 110 lb., by draining tunnels. Calculations of the oil remaining in the sands already exhausted by borings and of the oil recoverable by drainage into tunnels is in practice more difficult than in a theoretical example.

In oil sands the recoverable oil flows toward the bottom of the layer only very slowly. The gas pressure is not sufficient to lift the oil in the pump tubing more than a few feet; but drainage galleries of great cross-section will considerably facilitate the downward flow of the oil toward the floor of the tunnel. Hence it is not possible to establish a ratio between the draining area of the vertical casing of a boring well and the horizontal galleries driven in the lowest part of the layer.

Moreover, the bubbles of gas, inserted between the grains of sands and the oil droplets, prevent the oil from flowing freely under the effect of gravity toward the floor of the strata. But when a drainage gallery has been opened in these oil sands, both gas and oil will separate easily, and oil can then flow freely toward the lower part of the strata. There remain only in the sands the quantities of oil retained by adhesion, namely, 40 to 50 kg., or 88 to 110 lb.

In one of the three mining works at Pechelbronn, Alsace, 4,450 meters (14,600 ft.) of subterranean galleries had yielded until Sept. 1, 1920, a total amount of 55,000 cu.m. of oil (1,942,311 cu.ft.), consequently 1 meter (3.28 ft.) of gallery produces an average of 12.36 cu.m. (423.90 cu.ft.) of oil.

The subterranean working of petroleum requires certain special precautions which are necessary to avoid serious accidents or fires. Notwithstanding this fact, the new extracting method presents many advantages and will find its application in certain oil fields.

There exists a series of studies published in France on the working of petroleum by means of shafts and galleries. These are listed in the pamphlet of Paul de Chambrier "Exploitation du pétrole par puits et galeries," edited by Dunod; Paris, 1921; Price 5 fr. See also in the *Journal of Petroleum Technologists*, London, June, 1921, No. 27, "Working of Petroleum by Means of Shafts and Galleries," and "Notice sur l'Exploitation par puits et galeries des gisements pétrolifères," by Mr. Langrogne, engineer at the Service of Mines. *Annales des Mines*, XI Series, Tome XI, April, 1921, edited by Dunod, Paris, p. 323 to 353.

*Consulting engineer of the Pechelbronn Mines.

Oil Strike Reported in Arizona

SPECIAL CORRESPONDENCE

There is belief that oil has been struck in Arizona after many years of futile prospecting. The strike has been made in the eastern Whetstone Mountains, a few miles east of Huachuca Siding, at the junction of Pima, Santa Cruz and Cochise counties. Oil shales, fossil remains and several small seams of coal are to be found in the district. Mescal Springs, near the strike, has been known to carry oily water. The strike is said to have been made in shale and blue clay at the bottom of a well which was sunk for water to a depth of 320 ft. on the Wolferton ranch. The material burns readily and is reported to carry a material percentage of oil, of a paraffin base. The well will be sunk deeper with all speed, in the hope that a gusher will be developed.

The country for miles around is being located by miners unfamiliar with the proper procedure, and many others are hurrying to Phoenix to secure leases on tracts of state lands that lie near by. The district is situated about ten miles northeast of Elgin, twenty miles from Patagonia and fifteen miles west of Fairbank, all on the Benson-Nogales branch of the Southern Pacific railroad system. Texans declare the sand similar to that first struck in the Ranger district.

Book Reviews

The Engineer. By John Hays Hammond. Cloth; 4½ x 6¾; pp. 194. Charles Scribner's Sons, New York. 1921. Price, $1.25.

This little book is one of a "vocational series." Others are on "The Teacher," and (in preparation) "The Newspaperman," and "The Ministry."

The volume by Mr. Hammond is clear, thoughtful, precise, and astonishingly well written. Indeed, we should be inclined to give the author first prize among mining engineers for the translucent brevity of his style. A keen analytical insight is continually in evidence, and a comprehensive range of thought on every subject which is taken under consideration.

"The purpose of this book," the advertisement reads, "is to make clear to the young man who is interested in engineering the advantages and shortcomings of his profession and what determines his mental and temperamental fitness for it." First are taken up brief studies of the general profession of engineering, the qualities necessary in an engineer. "Nothing is more false than the more or less prevailing belief that imagination is only useful to the poet, artist, or philosopher, and should be suppressed by the practical man as dangerous. The engineer, practical as he is, must at the same time be as much of a dreamer as any of these, if his work is of any magnitude. He must have the power to see a thing before it exists."

The important natural qualities which the engineer must have, besides imagination, are "integrity of purpose, accuracy of thought, capacity for judgment, ingenuity, curiosity, the creative instinct, and an innate interest in the workings of material laws." An engineer, Mr. Hammond thinks, should be thoroughly educated. He does not even mention the "correspondence school" route. Moreover, he strongly advocates the pursuit of liberal studies before and during the technical studies, in order that the engineer may be broad and cultured. English is most important of all. "Surely, of all that makes up the background of any professional man's education English is by far the most important."

The study of engineering, the author believes, is an excellent training for any career, if the student eventually chooses not to become an engineer; and he is of the opinion that such a preparation for life is better than "a diversity of studies."

Mr. Hammond devotes a close-packed chapter each to the mechanical engineer, the civil engineer, the mining engineer, the electrical engineer, the chemical engineer, the marine engineer and the military engineer. Of the natural equipment of the mining engineer he says: "First, he must be physically robust, preferably athletic, with great endurance. Then he must have the restless temperament of the explorer, keen for new discovery, interested in unknown places, at home in wilderness, adaptable to strange and uncomfortable conditions. He must be a leader of men, human and humane, tactful, sympathetic, interested in man psychology, familiar with labor conditions and life on the bare 'living wage,' self-confident but never self-conscious, equal to sudden mob emergencies, and without prejudice of race, creed, color or nationality. He must have sure, instantaneous judgment, based partly on intuition, but largely on training and experience. He must have sudden courage, physical and moral, which means not only the fearlessness of the soldier but equally an indifference to criticism inspired by animus and to erroneous public opinion. He must have a constant sense of responsibility, knowing that the fortunes of thousands of men and women stand or fall according to the accuracy of his professional opinion. Most important of all he must be honorable and honest beyond all suspicion, meticulously scrupulous in the handling of public or private property trusted to his care."

J. E. S.

Claims Against Mexico. By R. E. Desvernine. Cloth; 5½ x 8; pp. 149. Privately printed, 24 Broad St., New York.

In view of the present interchange of notes between the United States and Mexican governments, the United States insisting on provisions for the adjudication of claims before recognition can be accorded the Mexican government, this book is timely. The author, a lawyer, well versed in international law, has made "A Brief Study of the International Law Applicable to Claims of Citizens of the United States and Other Countries for Losses Sustained in Mexico During the Revolutions of the Past Decade," to quote from the subtitle, and first sets forth the historical basis for the present complex legal situations. In Chapter III he deals with the presentation and adjudication of international claims. Chapter IV discusses land, petroleum, and minerals, and the effect of Article 27 of the Mexican Constitution, a section of particular interest to mining companies and engineers. Such subjects as obstacles and defenses to presentation of claims and the measure of damages are also treated. Lindley M. Garrison, former Secretary of War, in a foreword terms the book's "usefulness unlimited in its field" and a "unique and valuable contribution to the subject." To anyone wishing a survey of the status of American mining claims against Mexico the book is to be highly recommended.

F. E. W.

Michigan Minerals — The Michigan Geological and Biological Survey, Lansing, Mich., has issued Publication 29, Geological Series 24, a cloth-bound book of 214 pages devoted to the metallic and non-metaliic mineral industries of the state for 1918 and prior years. An appendix contains a directory of all producers.

Technical Papers

Metal Statistics—"Statistische Zusammenstellungen über Blei, Kupfer, Zink, Zinn, Aluminium, Nickel, Quecksilber und Silber," published by Metallgesellschaft, Frankfurt am Main, Germany, was recently received for the first time since the war, and since then the first annual (1920) "Year Book of the American Bureau of Metal Statistics," 115 Broadway, New York, N. Y., has been published. The German pamphlet has heretofore been the most complete and helpful compilation of metal statistics of its kind which has reached this office. The current number carries production statistics for the metals enumerated, from 1909 to 1918 inclusive, with price averages through 1920. The American publication covers only copper, lead, zinc, gold, and silver, but the figures given in all cases include those for the year 1920, and their timeliness adds considerably to their value. In common with the German book, the statistics given include production, consumption, prices, imports, and exports for the various countries, with summaries for the world. The first published effort of the American Bureau in this field compares creditably with the older publication and is in many respects superior, particularly from the American standpoint. No doubt there will be a gradual extension of the metals covered, finally including, possibly, the non-metallic minerals. World-production statistics are particularly hard to secure, and it is probable that in collecting data on a number of other products, information could be secured with comparatively little more trouble.

Mineral Resources—Recent publications of the U. S. Geological Survey, Washington, D. C., in the Mineral Resources series include: "Gold, Silver, Copper, Lead, and Zinc in California and Oregon in 1919" (forty-five pages); "Talc and Soapstone in 1919" (four pages); "Coke in 1918" (eighty-nine pages); "Zinc in 1918" (forty-seven pages); "Gold, Silver, Copper and Lead in Alaska in 1919" (ten pages); Silver, Copper, Lead and Zinc in the Central States in 1919" (fifty pages), and "Antimony in 1919" (twenty-four pages).

Tucson and Amole Mountains—Bulletin No. 106, Geological Series No. 2 of the University of Arizona, includes a geological reconnaissance of the Tucson and Amole Mountains by Olaf P. Jenkins and Eldred D. Wilson, together with notes on the southern section of the Amole mining district by Milton A. Allen. The pamphlet is published by the Arizona Bureau of Mines; G. M. Butler, director; Tucson, Ariz.

Safety—"The Safety Organization of the Old Dominion Mine at Globe, Ariz.," is discussed in U. S. Bureau of Mines *Reports of Investigations* No. 2,260, obtainable on request to the Bureau.

ECHOES FROM THE FRATERNITY

Hoover Suggests Remedy for Rehabilitation of Industry and Commerce

The following is an abstract of a recent address delivered in Boston by Herbert Hoover, Secretary of Commerce:

Considerable conflict of opinion exists as to the future of our foreign trade. Some extreme groups insist that inasmuch as our exports comprise but 10 per cent of our total production, therefore our foreign trade bears only this ratio to our economic life, and that consequently our true course should be to devote ourselves to the healing of internal economic wounds. Other extreme groups consider that the only remedy for our internal situation is a restoration of export trade. In either case, we must not allow the present extreme industrial depression to obscure our view.

Exports are vital to the stabilization of our industries, of price levels, of wages, and of employment. While exports cover but a small per cent of total production, on the other hand they comprise a large percentage of the production of certain industries. For instance, we generally export 20 per cent of our wheat, 60 per cent of our cotton, and 75 per cent of our copper. Unless a market is found for surplus production of our great industries, we shall continue to keep some 25,000,000 of our people in reduced buying power.

It is most essential that our economic relations abroad are maintained. The recovery of our foreign trade can march only in company with the welfare and prosperity of our customers.

We have not alone shifted from a debtor to a creditor nation, but our capacity for surplus production in food and manufactures has grown enormously, until we have taken front rank of the world in foreign trade. The direction of our trade has also shifted. During the last year about one-half of our entire foreign trade was with Europe, but of our exports to them, 80 per cent were foodstuffs and raw material. Of our exports to states outside of Europe, about 75 per cent were manufactured goods. Europe in turn is our serious competitor in the marketing of manufactured goods to the rest of the world.

Any improvement in European production of manufactured goods will favorably affect our market for those raw materials such as cotton and copper, where we possess the final supplies. In considering the demands for such raw materials, we must remember that the manufacturing countries of western Europe have lost, for a long time to come, any great markets in Russia and Turkey; the population of Europe as a whole has not the consuming capacity for manufactured goods that it had before the war, and, therefore, we must expect a less than pre-war consumption in Europe for their remanufacture of our raw materials. On the other hand, they will find, after this deflation is past, that the markets of the rest of the world are larger than before the war. I am confident they will gradually return to a pre-war demand for our cotton, copper, and other products.

Our whole financial relation with the rest of the world has greatly shifted, and the war has reversed our position so that the world, principally Europe, owes us today from thirteen to fifteen billions of dollars. We have not only loaned money to the Allies, but have also increased the surplus of our exports. Unless we would cease a large part of our war increased productivity, with all the resulting unemployment, and losses of such a cessation, we must continue for some time to export in excess of our imports. If today we stop giving more credits and demand payment of interest on debts due our Government, our exports will further decline, and the decline will find its interpretation in more unemployment among our own people and more displacement of our industries.

On the production and marketing side of our commerce, we can say that our food exports should remain on a greatly enlarged scale; that the demand for our raw materials should slowly increase toward pre-war amounts; that in respect to our manufactures, we should be able to hold special fields of repetitive production and ingenuity; that we will need to make a fight to hold the markets for manufactured goods where we come more directly into competition with the European manufacturer, but that we can do it if we will work and apply our brains to it.

We are suffering greatly in this immediate world-wide industrial depression. This depression is partly due to the war, partly to our post-war boom, with its speculation, extravagance and slackening of efficiency. The Government can help the public by removing the obstruction to commerce and industry, but the real cure for all depressions is courage and applied intelligence, and the return to primary virtues of hard, conscientious toil and economy in living. While our recovery may be slower than some may expect, nothing can prevent the prosperity of a country where people have enlightenment, wish to work, wish to produce, and wish to do right by their neighbors.

Dredge Operators and A. I. M. E. Members Fraternize in Nevada

The joint field meet of the San Francisco Section of the A. I. M. E. and the Dredge Operators held in Virginia City, Nev., district, June 27, 28, was highly successful in interest and good fellowship. Forty-four members and guests from California and Nevada were on the trip. F. W. Bradley, Charles W. Gardner, Albert Burch, T. A. Rickard, L. D. Hopfield, Frank H. Probert, Roy H. Elliott, Edwin Higgins, Gerald H. Hutton and others were present. Gerald H. Hutton arranged the details of the two-day trip.

On Monday morning the adit of the United Comstock Mines Co. was visited. The visitors were taken to the face in mine cars hauled by storage-battery locomotive and there witnessed a Hoar loading machine in operation. They were then taken underground at the Yellow Jacket shaft and shown the development work in the orebody which is to be mined by the company. An excellent luncheon was next served, and in the afternoon the Gold Canyon dredge was visited.

Two papers were presented, one by George J. Young on "Mining at Gold Hill, Nev.," and the other by Gerald H. Hutton on "Dredge Mining Practice." Mr. Young presented an historical sketch of Gold Hill operations and a brief summary of present developments. F. W. Bradley, Albert Burch, Roy H. Elliott, Governor E. D. Boyle, and others discussed the paper. T. A. Rickard then introduced a resolution, which was unanimously adopted, to the effect that the members wished success to the efforts of the United Comstock Mines Co.

On Tuesday morning the North End mines at Virginia City were visited. The members descended the C & C shaft and inspected workings on the East and Hardy veins, and following this they were taken up to the Sutro tunnel level and through the north lateral to the Sutro tunnel.

July Meeting of Columbia Section, A. I. M. E.

There were present at the regular monthly meeting of the members of Columbia Section, A. I. M. E., Director and former chairman of the section, Stanly A. Easton; former chairman James F. McCarthy, and about sixteen others.

A meeting of the Columbia Section of the A. I. M. E. was held in the Davenport Hotel, Spokane, Wash., on July 1. There has been arranged by the local sections of the A. S. C. E. and A. I. M. E., the Executive Committee of the Associated Engineers, and the Executive Committee of the Washington State Metal Mining Association, a meeting consecutively for the first, second, third and fourth Fridays in each month. This is for the purpose of concert and co-operation, which, with the usual Wednesday noonday meeting of the Associated Engineers, enables the local engineers to keep in close touch among themselves and to be advised upon all public as well as engineering questions.

The North Coast Branch of the Canadian Institute of Mining and Metallurgy recently met at Alice Arm. B. C., Major C. B. North, of the Dolly Varden mine, occupying the chair. Among the speakers were Bert Kergin, M.L.A.; G. P. Riel, G. C. Mackenzie, H. Fowler, M Peterson, H M Roscoe, and John Stark.

MEN YOU SHOULD KNOW ABOUT

Henry C. Carlisle is in Montana inspecting mining properties.

Percy E. Barbour returned to his desk at the A. I. M. E. offices last week.

L. H. Goodwin is in the Black Hills of South Dakota for two months.

Daniel Guggenheim sailed for Europe on July 5, on the "Aquitania."

L. E. Foster, of Gila, N. M., is visiting Kansas City, Kan., and Chicago, Ill.

Robert Linton, of New York City, has returned from a professional trip to Mexico.

Holland S. Reavis has moved from 120 Broadway to 115 Broadway, New York City.

James P. Porteus, of the Bonney mine, Lordsburg, N. M., is in Chicago, Ill., on mining business.

M. C. Lucky, who has been abroad for some time past, returned last week from Maracaibo, Venezuela.

C. A. Bennett, of Rochester, Nev., has just returned from an inspection of mines at Candelaria, Nev.

F. G. Janney, general superintendent of mills for Utah Copper Co., at Garfield, Utah, is leaving for New York.

Roy M. Wolvin, president of British Empire Steel Corporation, has returned to Montreal from his trip to England.

Eugene Dawson, mining engineer, left New York on July 9 to examine and develop placer mining properties in Equador.

J. R. Finlay, of New York City, is making an examination of the Chapin mine at Iron Mountain, Mich. for the Chapin Estate.

G. E. Hyde, associate of the school of mines at Okago, New Zealand, is now volcanologist to the Mexican Geological Survey.

Kirby Thomas, of New York City, is making an examination of the Northcliff mine, on the northeastern arm of Gowganda Lake, Ontario.

Alfred James (past president and formerly honorable secretary) has resigned from the Council of the Institution of Mining and Metallurgy.

George H. Garrey, mining engineer, of Philadelphia, Pa., who has been making examinations in New Mexico, recently moved up to Tonopah, Nev.

M. Chipart, director of the national school of mines at Saint-Etienne, France, recently was elected president of La Société de l'Industrie Minéral.

S. C. Lind, of the Reno Station of the U. S. Bureau of Mines, and **F. C. Lincoln**, director of the Mackay School of Mines, were in San Francisco, Cal., recently.

Robert M. Raymond, of the Columbia School of Mines, who recently spent several weeks in Mexico, was in Jerome, Ariz., over the Fourth. He has now returned to Mexico.

Alan M. Bateman of New Haven, Conn., has gone to Alaska to go over the exploration and development of the properties of the Kennecott Copper Corporation and will return in September.

John Briar, of Des Moines, Iowa, has been made secretary to the War Minerals Relief Commission. For many years Mr. Briar has been clerk to the Committee on Interstate Commerce of the Senate.

Ernest Bamberger, general manager for the Ontario Silver Mining Co., has returned to Salt Lake City, Utah, from the conference in Washington of representatives of the lead mining and smelting industries.

C. P. Ross, of the U. S. Geological Survey, has been ordered to report to the Oregon Bureau of Mines and Geology to co-operate in the work of mapping the regional geology of the Wallowa Mountains.

Thomas M. Buley, of the State Consolidated Oil Co. of California, which controls a large area of oil properties in the Western States, has completed a tour of inspection of the Alberta and Peace River oil fields.

Irving A. Chapman, of Brooklyn, N. Y., has joined the staff of Smith, Brodie & Lunsford, accountants, as specialist in engineering and cost work. His office is in the Woolworth Building, Broadway, at Park Place, New York City.

F. F. Sharpless, secretary of the A. I. M. E., expects to visit Wilkes-Barre, Pa., at an early date when he will confer with the officers of the local section on the final arrangements for the Wilkes-Barre Meeting of the Institute.

Frederick T. Rubidge, mining engineer, and manager of mines, with Ladenburg, Thalmann & Co. since 1910, is now giving part of his time to consulting work and management for outside interests. His office is at 41 Broad St., New York City.

G. L. Hurst, until recently manager of the gold dredge department of the Bethlehem Shipbuilding Corporation, has opened an office in the Flatiron Building, San Francisco, Cal., and will engage in mechanical engineering, specializing in gold dredge work.

F. A. Wildes, superintendent of mines for the state of Minnesota, is to be transferred from his present headquarters at Hibbing, Minn., to St. Paul, to facilitate the handling of business pertaining to his office and to take charge of the land department for the state.

T. Skewes Saunders, for several years general manager for the Dos Estrellas Mining Co., El Oro, Mexico, has severed his connection with that company and has opened an office at room 525, Edificio "La Mutua," Mexico City, where he will engage in mine examination and consulting engineering practice.

Ambrose Swasey, of Cleveland, Ohio, sponsor of the Engineering Foundation and past president of the American Society of Mechanical Engineers, has been elected to honorary membership in the British Institution of Mechanical Engineers, in the British Institution of Mining and Metallurgy, and in the British Institution of Mining Engineers.

Prof. C. Schlumberger, ingénieur en chef des mines, professor in L'Ecole Nationale Supérieure des Mines, for personal reasons and at his own request has been placed on the retired list. Our readers will recall his treatise on electrical prospecting, a translation of which appeared in *Engineering and Mining Journal* in the May 7 and 14 issues.

Annie H. Martin of Reno and Carson City, Nev., was nominated on July 8 to be assayer in charge of the U. S. Branch Mint at Carson City, Nev. Miss Martin is a native of Empire City, Nev., and has devoted her life to the study of political and economic subjects. She is a graduate of the University of Nevada and of Leland Stanford, Jr., and has studied at a number of other well-known schools. She has also traveled and studied in Europe and the Orient. In 1918 she was an independent candidate for federal senator from her state, to which she had brought woman suffrage in 1914.

Sidney Paige, of the U. S. Geological Survey, is making a tour of inspection of the geological field parties that are now engaged in field work.

The principal field parties of the U. S. Geological Survey that will do work in Alaska this summer are on the ground and have their work well under way. **F. H. Moffit** and his party reached Snug Harbor on July 2 and began work in the Inniskin Bay oil field. **S. H. Capps** and his party reached Portage Bay on July 2 and began work in the Cold Bay oil fields. **G. C. Martin** reached Fort Gibson on July 8 and commenced field work along the Yukon River.

Mining engineers and metallurgists recently in New York City included: **H. Lloyd Moris** of Steadman Moneta, Canada; **Gustaf M. Lundberg** of Madison, Wis.; **James M. Little** of Patagonia, Ariz.; **Warren D. Thompson**, now of Stonington, Me.; **Joseph Daniels**, of the College of Mines, Seattle, Wash.; **Louis S. Cates**, and **Lester A. Blackner**, also now of Salt Lake City, Utah.

OBITUARY

Alexander Faulds, Vancouver, B. C., mining engineer, who investigated the Fernie explosion in 1905 for the Dominion government, was drowned recently in Stanley Park Reservoir. Mr. Faulds was seventy years old.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

In Washington little progress is reported in the discussion of the new Tariff bill in the House during the past week; opposition thus far has centered on the dye schedule and on the American valuation clause. Action on the bill to liberalize the War Minerals Relief Act is still delayed. A change in the design of the silver dollar now being minted from Pittman Act silver has been recommended.

Stagnant conditions continue unchanged in most mining districts. In Grass Valley, Cal., three companies, the Empire, North Star and Idaho-Maryland, have shut down, following the refusal of the men to accept a $1 reduction in wages. The Quincy Mining Co., in the Michigan copper country, made a further cut in wages of about 6 per cent on July 1. The asbestos industry in Quebec, once so thriving, has slackened, wages have been cut, and the companies are working but four days per week. Iron ore shipments from Lake Superior district mines for June were less than half of those in the same month last year. In Utah, on the other hand, the Tintic district is very busy and is said to have produced more in the first half of 1921 than from Jan. 1 to July 1 a year ago. From Australia it is reported that the Mount Morgan company, in Queensland, may reopen soon through some arrangement with the state government.

In the Michigan iron country, R. S. Archibald, of Negaunee, is suing the principals who figured some time ago in an iron ore land deal with Henry Ford, asking $75,000 for services rendered. The Ontario government is said to have refused to aid in building a light railway through various northern camps by guaranteeing bonds up to $3,000 per mile.

New Potash Plant To Be Built

The Bonneville Development Co., in Utah, having secured under the mineral leasing laws a large acreage of ground containing salt brines, has announced that it will erect a fifty-ton potash plant in the fall. This will be situated east of Wendover. The process to be used is said to be the same as that employed by the Salduro plant at Salduro, Utah. The officers of the new company are: J. L. Silsbee, president; J. A. Kahn, vice-president; J. L. Brown, secretary, and M. H. Sowles, treasurer.

Operations have been temporarily suspended by the Salduro Chemical Co. It is said that the supply of potash dust secured by evaporation has been inadequate to keep the plant supplied. The cooler weather is held to be responsible for the lessened evaporation. It is thought work will be resumed in the fall.

The Boswell Mine, in Southwestern Oregon

New Bonanza Gives Promise of Continuance at Depth — Discovered in 1914, It Has Interesting History — Causes Revival of Interest in Gold Quartz Mining and Prospecting

BY HENRY M. PARKS

Written for *Engineering and Mining Journal*

THE DREAM of pioneer miners in southern Oregon, that rich orebodies would be encountered at depth, seems about to come true in the Boswell mine, in Josephine County. From the days when the pioneer of '49 found wealth in the bars of the Rogue and the Illinois rivers, and pushed over into the trackless reaches of the Applegate district, quartz miners have anticipated that ultimately some of the rich mines of the continent would be developed in that region. There have been surface pockets of fabulous wealth that were sensations of their day, and high grade ore has come from many prospect shafts and tunnels, but for various reasons in this, as in other sections of Oregon, there has been no deep mining, speaking in a comparative sense. The deepest mine in the State of Oregon has attained a depth of only about 700 ft. and in Josephine and Jackson counties there has been no deep mining development in recent years.

It was in February, 1914, that R. Boswell & Son found a trace of pay dirt on the land which had been purchased from the State of Oregon in 1913. This discovery was made when they were running out the lines of their land preparatory to prospecting the purchase. The history of the mine in its early development was not unlike that of many promising prospects in the mining districts of the west. After the initial work had revealed the possibility of rich returns, the property was tied up for nearly three years as a result of a legal action instituted against the owners of the property, delaying work until the early summer of 1917. The title and rights of the Boswells were fully sustained by the courts.

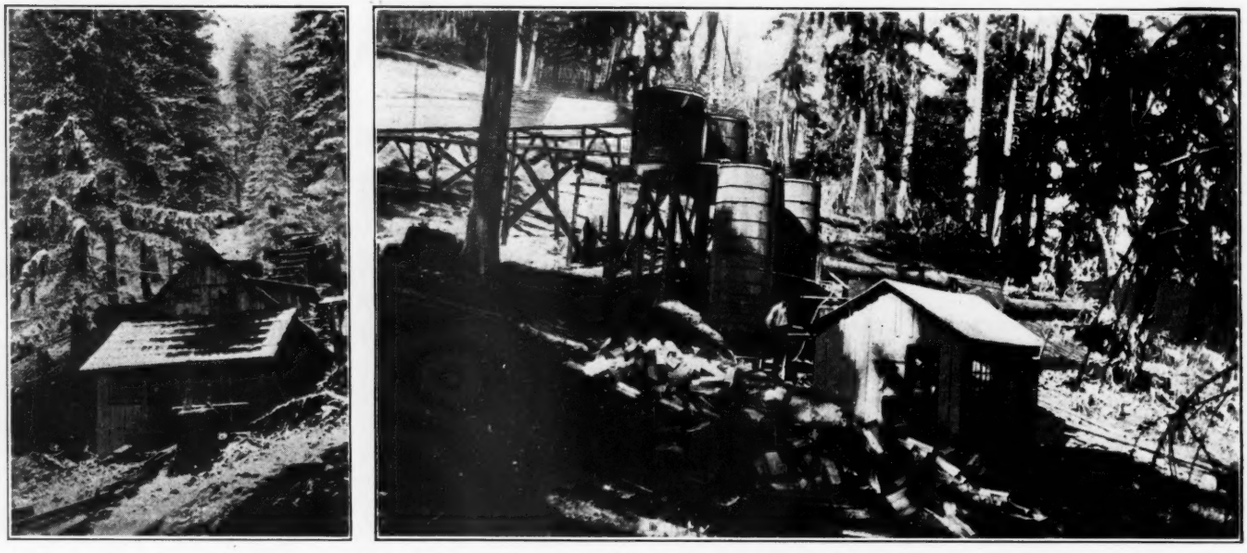
The development work that has been done reveals what appears to be a fissure vein, and it seems that the hope of the present owners that it will develop as a deep mine is justified. Their belief in the possibility of rich orebodies seems confirmed by the character of the formation, and the present conditions warrant the expectation that production will provide funds sufficient for extensive underground development.

The Boswell mine is located near Sucker Creek in the Holland mining district in the southern part of Josephine County, Oregon, about 45 miles southwest of Grants Pass. It comprises the southwest quarter of Section 36, Township 39 South, Range 7 West, Willamette Meridian. It was in February, 1914, that George S. Barton, who had recently come from Tonopah, Nev., to southern Oregon, was invited by the Boswells to inspect their showings. At that time a small surface cut and some prospect holes, where work had been undertaken to sink to bed rock, constituted the prospecting that had been done. A sample of the dirt was taken at the point where the small cut had been made, and this was tested by panning.

"I will show you something when I pan this" was the remark made by Mr. Barton. Results proved that truth was spoken in jest. Small pieces of a brownish oxidized material about the size of a pea were shown. The material crumbled easily and was found to be full of fine and coarse gold. The showing was better than that from previous panning of surface dirt, and examination revealed that it came from the formation in the small cut. Work the next day brought down $3.25 in gold dust from the pannings. What appeared to be a well defined vein had been revealed and opened up to four inches of high grade, and which, with a little further work, widened to ten inches.

In May, 1917, the Boswells installed a 3½-in. Huntington mill, a Challenge ore feeder, and a 6-hp. gas engine. A muller was retained that had been used for some time before the mill was installed. With this plant, they recovered $46,000 in bullion by the end of the summer of 1917. At that juncture the operation and development of the property by the Boswells was interrupted by the world war. Young Boswell was called to the colors, and it was his request to his father that the development of the mine should await his return. To this, the father agreed and the promise was fulfilled, in that the mine was not again operated by Mr. Boswell. The boy died in France and the father had no desire to again resume operations.

Public attention was directed to the Boswell property in the summer of 1917, when father and son were held up and robbed by masked highwaymen, who procured $6,000 in gold bullion and dust. Both of these bandits were captured thereafter and one is serving time



LEFT—HUNTINGTON MILL BUILDING, BOSWELL MINE, SOUTHWESTERN OREGON. RIGHT—12-TON CYANIDE PLANT

in the Oregon State Penitentiary at Salem. The other was convicted of bank robbery in California, and is serving a term in San Quentin prison.

In December, 1920, George S. Barton and M. Norden, of Seattle, Wash., with whom were associated Tacoma and California people, negotiated the purchase of the property from Mr. Boswell. In January, 1921, the Boswell Mining Co. was incorporated under the laws of the State of Oregon. The purchase price was $150,000, of which one-third had to be paid in cash before a pick could be stuck into the vein. The new owners installed a 7 x 9-in. Blake-type crusher, a Huntington mill, and a small cyanide plant. A tramway was built from the tunnel entrance to the mill, a distance of about 800 ft. The operation of the mill began about April 1, since when about 2,500 oz. of gold bullion has been shipped, all of which was extracted from ore taken above the 30-ft. level. At present the vein is open to a depth of 76 ft. and shows a width of approximately four feet. The tailings pond contains material that runs from $75 to $228 per ton and contains approximately $30,000 in gold. The recovery from the tailings has been about 95 per cent. The average recovery with the mill, by amalgamation, has approximated $800.

The vein in the Boswell mine strikes approximately east and west and dips about 75 to 80 deg. north. It is from two to four feet in width and has well defined walls, the rock on both sides being greenstone—probably an altered andesite. The vein is largely quartz and silicified greenstone, the most conspicuous feature of which is a peculiarly colored band of gouge material, which carries a large amount of gold.

Samples are obtained occasionally in the vein of a steel-gray material, mingled with the quartz, and upon analysis is found to be approximately an arsenide of iron, probably lollingite. The sample analyzed by the State Bureau of Mines and Geology also carried 36.2 oz. of gold. This lollingite will probably be the important mineral carrying values when the operation has progressed beyond the oxidized zone.

On account of the limited equipment on the property at present there has been no attempt to mill any portion of the vein other than the oxidized gouge material. The company plans more extended prospecting work to determine the possibility of contiguous veins. As previously stated, the development so far indicates the possibility of values at depth, and the formation is also of a character in which the occurrence of large orebodies may be reasonably anticipated.

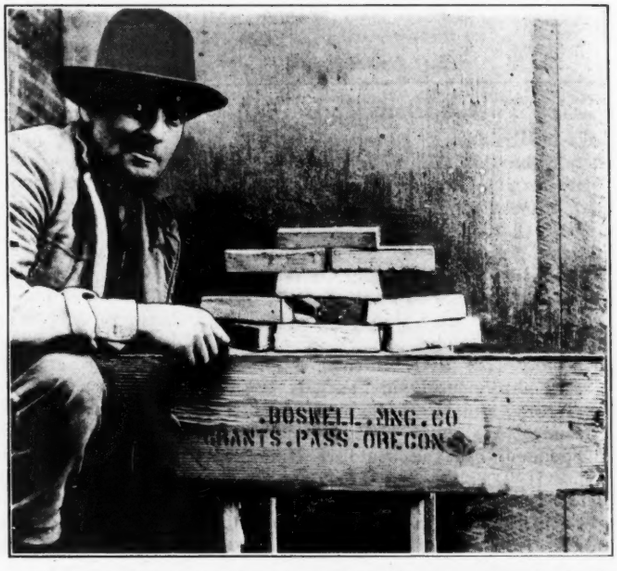
The region in which the Boswell mine is located has been constantly producing gold for seventy years. The Waldo Corporation, George M. Esterly, manager, is operating the Logan hydraulic placer mine at Waldo, Ore., which is about 12 miles from the Boswell mine. The Esterly property is one of the well known placer mines of southern Oregon. During the last year, a tunnel, 1,650 ft. long was completed, that obviates the necessity of using hydraulic elevators to remove gravel from the workings. The gravel is now flumed through the tunnel, and the water formerly used in the elevator is utilized in washing the gravel, thereby greatly increasing the output and efficiency of this extensive plant. The old Channel mine, another placer, is again a producer.

Grass Valley Mines Shut Down

The Empire, North Star, and Idaho-Maryland mining companies, operating in the Grass Valley district, California, stopped all work except that of pumping on July 1, as a result of the refusal of the men to accept the $1 reduction in wages announced on June 2. The decrease proposed would make miner's wages $4.62½ and those for shovelers $4.25 per day. On June 19 the local Mine Workers' Protective League proposed that the wage reduction be made 50c. per day. The operators refused to compromise.

To Finance Export of Copper To Italy

To assist in financing the exportation of 500 tons of copper to Italy, the War Finance Corporation has agreed to make an advance of $145,000 to an American banking concern.



$17,600 IN GOLD BARS FROM NINE DAYS' RUN WITH 3½-FT. HUNTINGTON MILL AT BOSWELL MINE, IN APRIL, 1921

Principals in Ford Iron Land Deal Sued

R. S. Archibald, of Negaunee, Mich., Asks $75,000 for Services from Osborn, Case, Hudson, and Davidson

Ralph S. Archibald, mining engineer of Negaunee, Mich., through his attorneys, has entered suit in the Circuit Court of Chippewa County, Michigan, against Chase S. Osborn, Fred Case, and Robert Hudson, of Sault Ste. Marie, Mich., and Otto C. Davidson, of Iron Mountain, Mich., for the payment of $75,000 for services which Mr. Archibald claims that he rendered the defendants prior to the time that they turned over the holdings of the Michigan Iron & Land Co. in Michigan and Wisconsin to Henry Ford. The defendants, in 1919, secured an option on most of the stock of the Michigan Iron & Land Co., and Mr. Archibald maintains that he was consulted and gave information regarding the mineral value of the 400,000 acres, receiving no compensation for his work. Mr. Archibald was familiar with the holdings, as he did work for the company at various times, and he believes that the information which he gave to the four men was used to good advantage when Henry Ford sought mineral and timber lands in the northern peninsula of Michigan. Mr. Archibald maintains that the holdings of the Michigan Iron & Land Co. were purchased for approximately $1,000,000 and turned over to Ford for $3,000,000, a profit of almost $2,000,000 for those who figured in the deal. It is likely that the case will be called for trial in September at Sault Ste. Marie, Mich.

Chase S. Osborn is a former governor of Michigan and has played a prominent part in Michigan mining affairs; Otto C. Davidson is superintendent of the mines on the Menominee and Gogebic ranges for the Oliver Iron Mining Co. Mr. Archibald is engaged in consulting work and looks after the interests of fee owners on several of the iron ranges. The case will be bitterly contested and will probably find its way into the higher courts.

June Iron Ore Shipments Light

Iron ore shipments from the Lake Superior district for June were light. The movement up to July 1 was 40 per cent of that for the same period in 1920. The tonnage sent forward in June was 3,600,989, in comparison with 9,233,666 tons last year, or a decrease of 5,632,677 tons. The total tonnage handled by the docks this season to July 1 was 6,371,227 tons, a decrease of 10,069,278 tons, as 16,440,505 tons was shipped in 1920 up to July 1. It is likely that more ore will be handled during July, but orders are coming in very slowly.

Montana Power Co.'s Electricians Quit Work

The Montana Power Co.'s electricans in Montana and for that matter all the electricians of the state, have quit work, rather than accept a reduction in wages of $1 a day. The Associated Industries threatens to create an open shop unless the electricians return, and the latter are ignoring the threat.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Little Progress in Discussing New Tariff Bill

Opposition Thus Far Centers Against Dye Schedule and American Valuation—Hoover Defends Latter

Discussion of the tariff in the House of Representatives did not get far beyond general statements during the week ended July 9. So much of the opposition is confined to the dye schedule and to American valuation that little attention has been given any of the 10,000 individual items which make up the bill. Nevertheless, it is evident that the proposed duty on petroleum and the proposed duty on several important mineral raw materials will be hard-fought items.

Representative Goldsborough, of Maryland, in the course of remarks before the House on July 9, touched on the petroleum duty as follows:

Under this bill, providing a tariff on crude petroleum of 35c. a barrel and on fuel oil at 25c. a barrel, everyone who runs an automobile or tractor, every householder who lights a coal oil lamp or stove, will have to pay the tax which is passed on to the consumer. Every railroad which burns oil and every steamer which burns American oil will pass on the charge to the American consumer in freight rates.

The independent oil companies, or at least some of them, charge that the opposition to the duty on oil is coming from the large corporations, because of their interest in Mexican petroleum. It is claimed that the duty is in the interest of 16,000 independent producers and refiners who are in danger of absorption by the more powerful companies. The large companies formerly controlled 80 per cent of the domestic production, it is declared by the independent companies, but this has been cut to 50 per cent in recent years, with the consuming public receiving the benefits of real competition. It is said that imports of Mexican oil have permitted the building up of a surplus of approximately 25 per cent, which is pointed to as the cause of the demoralization of the industry. Representative Goldsborough declared that the cheaper foreign oil is being imported and delivered at a fraction of the cost of production in the United States.

One of the principal arguments being used for the American valuation system is a statement made to the Ways and Means Committee by Secretary Hoover, who declared that there is no other alternative with unstable currency and exchange. On the other hand, it may be said that the majority of expert opinion seems to be against this change of policy, and it is predicted that American valuation will not be a part of the bill when it is enacted into law.

Representative Fordney, the chairman of the Committee on Ways and Means, made an extended defense of the proposal. He admitted that it has some disadvantages, but said that they are not comparable with the advantages which will flow from American valuation. Among other points he mentioned the ease with which actual dutiable values may be secured under this system. Instead of having to deal with foreign manufacturers and agents, whose interest is to mislead and to deceive, the American manufacturer and dealer in whose interest the Government desires the information would be the principal source of this data. Moreover, it would be possible to compel the attendance of all interested parties at a hearing for the establishment of true market values. The plan would equalize the amount of duties paid on similar goods, regardless of the country from which imported. Foreign valuations discriminate against the high-cost countries in favor of the low-cost countries. The most potent argument, however, in favor of the system is admitted to be the fact that it does away with the troublesome matter of exchange and the difficulties of establishing foreign valuations at this time.

The Democrats are placing much stress on the fact that now, of all times, the tariff should not be changed. "At a time when this country has a vast surplus of gold," said one of the leaders of that party, "at a time when Europe, sadly in need of our products, can pay for them only in goods, we are building up a tariff wall."

Representative Frear, of Wisconsin, one of the Republican members of the Committee on Ways and Means, issued a formal report as a member of the committee opposing various features of the bill, particularly the dye schedule. He had some biting criticisms also to offer of a duty on crude aluminum and

on asphalt, and he described as prohibitive the rates prescribed for tungsten, manganese, and magnesite. He ventured the assertion that the steel industry is about able to walk alone, that it "has ever been protected" and "shows little need of tariff protection" at this time. The duty prescribed for potash will cost the American farmer $6,000,000 during the next two years, Mr. Frear declares, an amount "over 80 per cent of the total estimated increase in duties received from the entire chemical schedule in the 1921 rates over those of the Underwood Act."

Baruch Defended as to Copper Purchases

In view of the criticisms of Bernard M. Baruch, Senator Overman, of North Carolina, has had printed in the *Congressional Record* a statement of fact from the disbursing officer of the Council of National Defence, of which the following is an extract:

There has been considerable criticism of Mr. Baruch in reference to Government contracts for the purchase of copper. An investigation of the conditions under which the much-talked-of "fixing" of the price of copper was made will show that the basis upon which the price was fixed was the figures furnished by the Federal Trade Commission on the cost of production; also, that Mr. Baruch was not the chairman of the committee which fixed the price, and that the price as fixed was approved by the President of the United States.

From the time the appropriation for the War Industries Board ceased to be available until the records were finally turned over to the Council of National Defence by Executive order, Mr. Baruch personally paid the salaries of several employees necessary to finish the liquidation of the War Industries Board's accounts and to care for the records until they were finally turned over to the council.

He paid for all the stenographic, clerical, and other assistance necessary for the preparation of the final report of the War Industries Board, the only cost to the Government being that of printing at the Government Printing Office.

I can say that I know personally of upward of $100,000 which Mr. Baruch has paid on account of expenses which would have been proper charges against the Government had he cared to ask for reimbursement.

Arentz To Introduce Draft of New Mining Code

Committee Not to Press Bill at Present—Thought Advisable That Text Be Widely Distributed

The draft of a new mining code as prepared by the Ingalls committee is to be formally introduced in the House by Samuel S. Arentz, of Nevada. Mr. Arentz was designated to introduce the bill by the chairman of the House Committee on Mines and Mining. This step is taken so that copies of the law, with the proposed changes, may be available for distribution. It is not the intention of the committee to press this bill for early consideration, as it is believed wise to circulate as many copies of the law as possible, so that suggestions as to the effect of the changes may be received from those who would be affected.

May Change Design of Silver Dollar

As more than twenty-five years have elapsed since there has been a change in the design on the silver dollar, the House Committee on Coinage, Weights, and Measures has recommended the passage of legislation providing a new design which will be commemorative of the ending of the war with Germany.

Under the Pittman Act, 270,232,000 silver dollars were melted down. The replacing of these dollars has already begun, and more than 10,000,000 have been coined after the familiar design. The bill provides that there is to be no change in the weight or fineness of the silver dollar.

Action on War Minerals Relief Still Delayed

No action was taken during the week ended July 9 on War Minerals Relief legislation. Representative Rhodes, chairman of the House Committee on Mines and Mining, conferred at length concerning the situation with the Secretary of the Interior and the War Minerals Relief Commissioner. No conclusions were reached, and Mr. Rhodes stated after the conference that he could not comment on the matter until something more definite had been worked out. The committee is expected to take action soon.

Purchases of silver under the Pittman Act during the week ended July 9 were 441,119 fine ounces. This brings the total purchases under that act to 61,416,816 fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Shamva's Gold Last Year Cost £3 5s. 9d. Per Oz.—East Rand's Cost £6 0s. 10d. Recently—Russo-Asiatic's Holdings Valuable

BY W. A. DOMAN

London, June 29—Possibly owing to the increased operating expenses, and the parlous condition in which many of the South African mines now find themselves—were it not for the "premium" they would be compelled to close down—the cost of production of an ounce of gold is assuming increasing importance. For years the ton milled has been taken as the basis, despite acknowledgment of the fact that this is not altogether a safe criterion. Tonnage can be made at any time by increasing the quantity of waste or low-grade rock, and so keeping down the cost as reckoned per ton.

It is beginning to be recognized that the product should show the cost, as it affords a better indication of profitability. Last year the Shamva mines averaged £3/5/9 per oz., as compared with £2/6/5 in 1915. The Shamva is the lowest-grade property being worked in Rhodesia. The estimate of ore reserves at Dec. 31 last was 1,981,250 tons, valued at 4.1 dwt. The actual extraction in 1920 was 88.32 per cent, as against a theoretical of 90.54, so that with gold at the normal rate of 4/2 per dwt., there is only a moderate surplus after working expenses of 125/18 per ton are met.

The mine is exceptionally well managed. Originally, when the company was floated, the expenses were estimated at from 90d. or 96d. per ton. The war upset all calculations, and costs have risen in this fashion—1915, 99/8; 1916, 103/3; 1917, 109/9; 1918, 118/1; 1919, 114/6, and last year, 125/18. Some of the increase is due to harder rock being encountered, but much is attributable to the fact that everyone wanted a finger in the premium pie. Three of the levels, known as Prospect, No. 1 and No. 2, have pierced the hill from north to south. Last year 609,509 tons was milled, and 608,759 tons brought in, of which 319,100 tons represented "excess" ore averaging about 2.7 dwt. The total recovery was 96,718 oz. of gold, realizing, with premium, £538,887, of which £223,526 was retained as profit. Quarterly dividends of 7½ per cent were paid, requiring £180,000. The future of the property and the prolongation of its life depend mainly upon the ability to remove and treat the large tonnage of low-grade overburden profitably.

At the annual meeting of the East Rand Proprietary mines, Sir Harry Skinner went exhaustively into the position, and showed that at one period recently the cost of winning an ounce of gold was £6/0/10. Here even the premium failed to give salvation. The trouble is that although the claim area is large, a considerable percentage of it contains unprofitable ore, and the working faces are so widely separated that costs are abnormally high. Costs have risen from 19/4 per ton in 1914 to 27/7 per ton last year, and averaged 28/- per ton for the first four months of the current period. The government has been consulted as to the position, and a commission of engineers has examined the mine. Despite the several suggestions put forward, no definite

or satisfactory plan of working has yet been evolved. The company possesses a fair amount of cash, and should see the present year out under even worse conditions. The debenture holders are safe; but, making allowance for the assets, the ordinary shareholders are not likely to get a substantial sum. A cessation of operations would be disastrous to the local community.

In one sense the report of the Russo-Asiatic Corporation is disappointing, as shareholders must await the annual meeting before learning the result of the negotiations between the directors and the Soviet government in regard to the return and working of the properties. That the areas have a tremendous potential value is clear from the fact that when they were confiscated the board put in a claim through the British Foreign Office for £56,000,000, based on the stocks of metals, materials, machinery and plant on hand, the profit value of the proved ore reserves and the cost of plant, machinery, and general equipment. A good idea of the nature of the assets can be obtained from the fact that they comprise, *inter alia*, concessions in the Urals and western Siberia covering 2,500,000 acres; twelve developed metal mines with 7,260,000 tons of proved ore reserves, unlimited coal reserves being developed for a yearly output of 2,000,000 tons; two copper-smelting plants, with an electrolytic copper refinery having a present yearly capacity of 14,000 tons; a lead plant, a zinc plant, iron mines, railways, and other equipment. The capital of the corporation is £12,000,000 in £1 shares, of which 8,461,587 shares are in issue, together with £614,117 of debentures.

AUSTRALIA

Queensland

Mount Morgan May Be Reopened Soon

Brisbane, June 4—Mount Morgan still remains closed down. The last suggestion for a settlement, which was made by the Minister for Mines, was for the Commonwealth government, either by itself or conjointly with the state government, to make advances to the Mount Morgan company to the extent of 90 per cent of the present value of the ore produced, and for the product to be held until it will realize a price that will pay for the cost of production at the rate of wages that the men demand. The acting Prime Minister, recognizing that this would mean finding over £50,000 a year for Mount Morgan alone, and unknown large sums to be advanced to many other big concerns in similar straits that would have claims to like consideration, was not "having any"; and the officials of the Mount Morgan company said they were not looking for vicarious charity in the conduct of their business. Within the last day or two, however, the State Premier has stated that he has met the manager of the company, and that as a result there is a probability of the mine being reopened soon, although on what terms is not divulged.

CANADA

British Columbia

Conditions in Kootenays Continue Stagnant—Phoenix Without Rail Connection

Nelson—A summary of mining operations throughout East and West Kootenay for the first half of 1921 shows a continuation of the stagnation noted at the first of the year, but with prospects of a gradual improvement in sight. Nugget operations at Salmo continue the only mining activity of note in the Nelson division. Consolidated M. & S. Co. of Canada, Ltd., maintains limited operations in Rossland, with the Sullivan mine, at East Kootenay, as the main tonnage producer.

Smelter operations at Trail continue on a reduced scale, with no definite information of the lifting of what practically amounts to an embargo on custom silver-lead ores. The Slocan silver-lead district shows signs of a little more activity, especially around Sandon. Silversmith continues to be the only property in the district showing ore reserves of any consequence. The Ottawa, near Slocan City, a Consolidated property under lease, gives promise of early production on a small scale. There is some other leasing along Slocan Lake, near Kaslo and at Ainsworth.

South Fork of Kaslo Creek is generally inactive, with exception of Silver Bell and Silver Bear, the former being the only one in that section to maintain operations throughout the winter. Operations throughout the Boundary district are at a low ebb, with the Providence mine, near Greenwood, leading in number of employees and in production. There is much optimism in East Kootenay with no great amount of work going on at any point except at the Consolidated's big Sullivan property.

Coal production in the Crow's Nest Pass region has been cut more than 50 per cent. There is likelihood of resumption at an early date of operations at the Nickel Plate mine at Hedley, which normally figures prominently in the list of British Columbia dividend payers.

Sandon—The general annual meeting of stockholders of Silversmith Mines, Ltd., has been set for Aug. 4, to be held at the registered office of the company here. The balance sheet to end of fiscal year, May 31, 1921, has just been issued and indicates a net gain for the year of $20,136.86. Income amounted to $260,404.54, all derived from sales of 2,195 tons of ore and concentrates. The directors' report indicates that 15,759 tons of ore was mined, of which 15,585 went to the mill. Mill feed averaged 21 oz. silver, 10.5 per cent lead, and 10.2 per cent zinc, and the mill product amounted to 2,021 tons of silver-lead concentrates. The accumulation of zinc concentrates now on hand approximates 2,000 tons. The period of mill operation was about six months, averaging 73.4 tons of feed per day. Ore reserves were maintained to the same extent as a year ago, current development placing in sight an amount equal to that removed. It is indicated that when metal prices are sufficiently high to warrant it, the company will again resume production operations.

Marysville—Some development is under way on a graphite discovery on Matthew Creek.

Grand Forks—Removal of rails on the Phoenix branch of the Canadian Pacific Ry. has been started, thus leaving Phoenix, for many years the scene of extensive operations of the Granby company, entirely without rail transportation, the Great Northern Ry. having already taken up the steel on its branch to that point. It is indicated that the entire branch will be abandoned, owing to the Consolidated M. & S. Co.'s decision to remove all equipment from the Emma mine, at Coltern, which had continued as a tonnage producer for some time after Granby operations ceased.

The Horn Silver mining company at Similkameen, has been acquired by Herbert Powell. Shipments have been made this year to the Trail smelter. It is probable that Mr. Powell will endeavor to interest capital with a view to the installation of a small reduction plant.

Trail—The Trail Board of Trade is again urging action on the part of the Dominion government with a view to securing an adequate protective tariff on wire rods and other manufactured products produced by the Consolidated Mining & Smelting Co. of Canada, Ltd. At a recent meeting of the organization J. J. Warren, president of the Consolidated company, described the efforts made by himself and others to secure a reasonable tariff on certain metals. He pointed out that definite promises had been made but that the Dominion government had since shown continued indifference to the matter.

Ore shipments received at the Consolidated company's smelter during the week ended July 2 are given in the following table:

Mine	Location	Tons
Bell-Beaverdell	Beaverdell	67
Knobhill	Republic	97
Nettie, L.,	Gerrard	18
Krao,	Ainsworth	2
Providence,	Greenwood	30
Surprise	Republic	92
San Poli,	.....	47
Company Mines	.....	10,947

Ontario

Government Refuses To Aid Northern Ontario Light Railways Project

Porcupine—A contract has been let for several thousand feet of diamond drilling on the Gold Island claims at Nighthawk Lake, near Porcupine. This was the first discovery of gold in the Porcupine district, and was found a number of years before the Hollinger and Dome were discovered.

Diamond drilling is being carried on on the Bewick-Moreing group of claims in Porcupine, and it is understood that a total of 5,000 ft. will be drilled.

A contract will soon be let for sinking the shaft of the Moneta mine an additional 600 ft., from which depth the property will be thoroughly explored.

Kirkland Lake—Interests connected with the control of the Wright-Hargraves mine, at Kirkland Lake, have taken an option on the Clevinger Prophet property, in Gowganda. Work is to be started soon.

It is understood that as part of the exploration program for the Tough Oakes diamond drilling will be carried on from underground.

A gang of men has started to work on the Lebel Lode property in Kirkland Lake, and a considerable amount of surface trenching will be done.

Cobalt—It is now definitely announced that the Government has refused the application of the Northern Ontario Light Railways for assistance. This project has been promoted with the idea of building light-gage railways, such as were used in France, to serve a number of the mining camps and outlying districts, which are now without transportation facilities. The proposal met the heartiest approval all through northern Ontario, and it was confidentially expected that the Ontario government would assist in guaranteeing the scheme to the extent of $3,500 a mile, which was all that was asked. It is understood, however, that the refusal of the government to give assistance will not prevent the promoters from going ahead with the work.

During the last two weeks a wave of exceptionally warm weather, with no rain, has given rise to a number of forest fires all through northern Ontario. Fortunately there was no wind, or there is no doubt that the worst disasters in the history of this section would have been repeated. Practically none of the mining companies were affected, except the Associated Gold Fields of Larder Lake, which lost several miles of its power line. During the last few days cooler weather and rains have lessened the danger of another serious conflagration.

Cobalt—Ore shipments over the T. & N. O. Ry. for May totaled 257 tons, Coniagas shipping 81, La Rose 42 and O'Brien 134 tons. Of this the Deloro S. & R. Co. received 134 tons, the Coniagas 79 and the A. S. & R. Co, at Perth Amboy, 44 tons.

Quebec

Asbestos Industry Slackens; Wages Cut and Most Operators Working Four Days Per Week

Thetford Mines—Industrial conditions in the asbestos district have been considerably depressed for several months. The period of intensive operation which was carried on for the last four years showed a marked relaxation during the early spring and at present not more than half of the former number of men are being employed. A small wage cut was effected and in addition most of the mines have curtailed operations to four days per week. Asbestos shipments are slow and further readjustments of production and prices will probably be required to bring back normal conditions. A number of the mining companies have discontinued operations for the present. Among these are the Johnsons Co., at Thetford Mines and Black Lake; Bennett-Martin Asbestos Co., at Thetford Mines and Coleraine; Black Lake Asbestos & Chrome Co., at Black Lake, and the Penningtons Asbestos Co., at Robertsonville. New plants that have joined the producers are the Harris Syndicate and the Paré-Thèbierge Syndicate, Coleraine, and the Maple Leaf Asbestos Co., Thetford Mines.

H. L. Parish, engineer for the Black Lake Asbestos & Chrome Co., has been appointed resident manager of the General Asbestos Co., East Broughton. Edward Ansen, of Montreal, has been named manager for the Black Lake Asbestos & Chrome Co. at Black Lake.

The Belanger Chrome Mines of the Black Lake-Caribou, which was closed down following the slump, has been reorganized with local capital and is again producing up to normal capacity.

CALIFORNIA

Pumps Pulled at Allison Ranch—Kennedy Mine Unwatered

San Francisco — Natomas No. 9 dredge, a 15-cu.ft. wooden-hull gold dredge operated by the Natomas Co. of California at Natoma, was sunk on June 16. The accident was caused by the wearing of a hole in the side of the hull. Natomas dredge No. 6 was shut down after about thirteen years' operation.

Jackson—The Kennedy mine has been practically unwatered, this work having been started Sept. 11. Considerable repair work must now be done.

A 7-cu.ft. wooden-hull gold dredge together with steam power plant has been purchased and assembled preparatory for shipment to the Placers de Oro de Bacubirito, Sinaloa, Mexican. The dredge was Oroville Ltd. No. 3 and was thoroughly conditioned by the Bethlehem Shipbuilding Corporation. The power plant consists of boilers, compound condensing engine and generator. Wood is the fuel to be used. The dredge will handle ground to a depth of 40 ft.

Grass Valley—The pumps have been pulled at the Allison Ranch and the mine allowed to flood.

Melones—The Carson Hill Gold Mining Co. treated over 15,000 tons of ore during May in its 30-stamp mill. This is at the rate of 18.5 tons per stamp per day, a record far in excess of customary Mother Lode practice. A large tonnage is being rapidly blocked out in the mine. Rapid progress is being made in sinking the Melones winze below the 3,500 level.

Carrville—A contract for a 1,200-ft. adit has been let by the Golden Jubilee mine on Coffee Creek.

NEVADA

Ore Shipments from Pioche Drop to Low Point

Pioche — Ore shipments from the Pioche district for the fortnight preceding July 7 were still negligible. The Bristol Silver Mines Co. continues the principal shipper, forwarding over 500 tons of $46 ore to the Midvale smelter.

The Nevada Silver Horn Mining Co., operating in the new Silverhorn district, has started to haul a carload of siliceous silver ore from development work into Pioche for testing purposes.

During June the new shaft of the Bristol Silver Mines was sunk 138 ft. The formation encountered was extremely hard, necessitating at times as many as thirty holes to the round.

Development work is progressing at the Prince Consolidated. The water pumped has decreased from 300 to 250 gal. per minute. Both crosscuts have now been advanced 10 ft. from the shaft, and the ground has been found well mineralized. Sinking will be continued until a large sump is provided, and the crosscuts will be pushed toward the ore bed and laterals run through the orebody in anticipation of early shipments to the Salt Lake smelters. Important geological data is being obtained from this work.

W. E. Brodie, a contractor, reports that the development tunnel on the Nevada Silver Klondike is now advanced 130 ft. from the portal, and is expected to run through the porphyry into the iron vein any day. Col. Maurice J. Fink, associated with Speath McKnight, has financed this company and John Carter Anderson is consulting engineer.

Leadville—The Leadville mine at Leadville, in northern Washoe County, owned and operated by A. A. Codd, of Reno, Nev., and associates, is being operated steadily. The mill recently built is successfully treating 35 tons of ore daily producing 6 to 7 tons of silver-lead concentrates which are hauled 40 miles to the Western Pacific. Two auto trucks of 3 and 4 tons respective capacity are operated six days a week, each truck making a round trip per day. It is estimated that the haul costs $10 per ton of concentrates. The ore is crushed to 80 mesh and 94 per cent of the lead and 91-92 per cent of the silver is said to be recovered.

COLORADO

Modoc Consolidated Elects Directors

Cripple Creek—Development work on the 1,650 level of the Granite mine has opened a new vein of payable ore for a distance of 100 ft.

The Hardwood property of the United Gold Mines Co. is responding favorably to development, and new electrical hoisting equipment has been installed.

The Modoc Consolidated Mines Co. is producing about 110 tons of ore daily, of an average value of about $15 a ton. At the recent stockholders' meeting the following directors were elected: E. D. Avery, president, Mark A. Skinner, Thomas F. Daily. A. H. Frankenberg, A. S. Rundall, and Chas. W. Higley.

MONTANA

Senator Clark and Con. Kelley Predict Better Times for Copper—Gem Mining Co. Reports

Butte—The Anaconda Copper Mining Co. is continuing its program of repair work, both at its mines in the Butte district and at the Washoe Reduction Works, at Anaconda, where a large force of carpenters is engaged. The company will also start cleaning its long flume furnishing the smelting and concentrating plants with water. Senator W. A. Clark, in a published interview in his newspaper, the *Butte Miner*, expressed the opinion that within six months there would be had a fair return to normal in the copper-mining industry. President Con. F. Kelley of the Anaconda company, though conservative as to predictions in connection with the copper metal situation, expressed the opinion that the coming months would see an improvement and a continuance of constructive forces working in behalf of a betterment in the metal trade.

The North Butte Mining Co. has from 5 to 6 ft. of ore on the 3,400 level of the Edith May vein, carrying a copper content of about 9 per cent, and the showing is improving in the face of the drift on the 3,600, encouraging the belief that the body of ore in evidence on the upper level will be picked up in the lower workings. Crosscutting north from the Granite shaft for the Jessie, the North and South Berlin veins and for the North and South Croesus veins is planned as the next development program of consequence. Raising in the Speculator shaft from the 3,200 level to the 3,000 will be undertaken soon.

Butte & Superior is pushing its workings on the 2,200 level of the Black Rock mine to reach the copper vein disclosed on the 2,050 level.

East Butte Mining Co. reports an increased tonnage put into reserve as the principal feature of development work thus far this year. The East Butte smelter continues to work practically at capacity on its own and custom ore.

Elkhorn—Boston & Montana is increasing its labor forces with the idea of rushing the installation of its milling equipment, which now is arriving in quantity.

Granite County—The Gem Mining Co., operating in the Granite County district, produced during the year ended May 31 sapphires valued at $132,232.56. The total production of sapphires was 66,189 ozs. These figures were made known when the company filed its report on net proceeds for the year. The deductions allowed under the law amount to $88,408.66, making the net proceeds of the company for the year $43,823.90. The tax collected under the law amounts to 1½ per cent of the net proceeds. The deductions allowed are for the cost of extracting and marketing the gems. The report came as a surprise to those who closely follow the mining market, as it was not known that the Gem company was producing and disposing of sapphires of anything approximating the value stated in the report.

MICHIGAN

The Copper Country

Copper Range Group Gets Coal at Low Freight Rate—Quincy Cuts Wages—Seneca Continues Development

Houghton—Copper Range costs should show a considerable reduction. Wages are down to a pre-war level, and the company is now operating with a new supply of coal which cost approximately half the price of coal shipped in last summer. Coal is still 100 per cent higher than in the pre-war normal years, but the saving effected will be large nevertheless. Copper Range was fortunate in being able to take advantage of the reduced lake freight rate on coal of 28c. per ton less before the former rate was ordered restored July 6 by the Interstate Commerce Commission. Before the higher rate went back into effect Copper Range had a little better than half of its year's supply ordered.

There was a slight gain in refined copper production by Baltic and Trimountain of the Copper Range group of mines in June, and Champion showed a slight loss. Champion failed to hold its men as well as the other two mines last month, finishing the month with a small net loss in man power. The fact that the drifts and stopes in Baltic and Trimountain gave a somewhat better yield in June also contributed to the gain at those properties. Copper Range has been taking on a few men of late from the iron mines, a number of experienced miners thrown out of work by the closing of some of the iron properties drifting to this district in search of employment. Copper Range, however, does not expect to increase its force much until fall, when many of its former employees who left the mines to take up farming for the summer will be back. In spite of this there are many idle men in the district. The three mines are producing, on their curtailed basis, about 2,500,000 lb. of copper per month.

Sinking is under way in Champion No. 1 shaft, in Trimountain Nos. 2 and 4, and in Baltic No. 2. Sinking in No. 3 Baltic is about to start. Drifting is in progress in all shafts. Copper Range is well opened ahead. No construction work of any extensive character is under way, and no changes are being made in the milling plants.

Beginning July 1, the Quincy Mining Co. adjusted wages about 6 per cent downward, making miners' wages $3.15 per day and trammers' $2.80. The new scale is about equal to that paid by Copper Range and the other operating mines of the district. There is no change in operating conditions at Quincy. The mine is working four and a half days per week with a minimum force. Production is understood to be about 1,000,000 lb. per month.

A total of 5,858,000 lb. of copper was shipped out of the Lake Superior district by boat in June. It is estimated that 1,000,000 lb. more, in the form of ingots, bars and wire, went out by rail. Production for the month, including Copper Range, Mohawk, Wolverine, Quincy, and the Calumet & Hecla refinery output, was 5,500,000 lb.

Although metal sales fell off sharply the last ten days of June, the shipment figures indicate fairly good sales for the month as a whole. Of the water shipments, Calumet & Hecla sent 1,500,000 lb. to Germany and Copper Range, 700,000. The remainder was for domestic consumers. The shipments by boat showed a considerable increase over those of May and those of June a year ago. In May the total was 5,310,000 lb. and in June of last year, 5,190,000.

The Seneca management reports "fair to good" ground in all openings. Drifting is proceeding in all levels, and in the 6th or bottom level the drift going northward continues to penetrate territory of an encouraging character. June figures are not yet available, but Seneca in May produced, during the course of development work, 37,566 lb. of copper, stamping a total of 1,787 tons of rock. The yield was 21.03 lb. to the ton. This does not indicate close selection. Rather the rock was sent to the mill just as it was taken out, no stockpile being accumulated. No attempt at production is being made. The principal efforts of the management are centered in opening work, and occasional shipments are sent to the mill. The rock is still being shipped to the Baltic mill. The two heads acquired by Seneca in the Centennial-Allouez milling plant will not, of course, be used until that mill is reopened, which will not be until Centennial and Allouez are again producing. By that time, it is expected, Seneca will have its new hoists installed at both the Seneca and Gratiot shafts. There will be no resumption of sinking until these new drums are in position.

Surface water in the Osceola amygdaloid branch of the Calumet & Hecla is now being handled by an electric pump recently installed on the first level of No. 16 shaft. The flow of water is not heavy, but it has been flowing over into the conglomerate workings and must be pumped. Calumet & Hecla is rapidly replacing all steam pumps with electric pumps, and a big saving will be the result.

Gogebic Range

Newport Company's Shafthouse Burned—Tilden and Ashland Mines Alone Working Full Time

Ironwood—The Woodbury shafthouse of the Newport mine was struck by lightning the night of July 1 and the wood sheathing set on fire causing considerable loss. The shafthouse, the largest in the district, is built of steel and from the collar to a point above the stockpile landing was enclosed with corrugated steel on a wooden frame. It was this frame that burned. There was also a shed used for a shelter for electric tramming locomotives and a drill sharpening shop close to the shaft, and these were completely destroyed. Trouble was experienced in getting water otherwise the damage might have

been small. The lightning storm was very severe, lasting twelve hours and causing several other fires and damage to electrical transmission lines.

Owing to the shortage of power since the burning out of their big generating unit at Ashland the local power company has been unable to supply the Puritan mine with power for its air compressor during the day and the mine has been working nights instead. The Oliver Iron Mining Co. is furnishing current to the power company from the Pabst mine power house where there are two 4,000-kw. generators.

The Tilden and Ashland mines are the only ones in the district working full time. The former has a high minimum royalty to pay, and is hoisting about 17,000 tons per month. The Ashland is shipping at the rate of 10,000 tons a month.

MINNESOTA

Mesabi Range

Ore Loading at Hill-Annex Pit Resumed

Marble—The Interstate Iron Co. has resumed loading ore at its Hill-Annex open pit. This is to be done on day shift only.

Virginia—The dewatering of the Lincoln shaft, operated by the Interstate Iron Co. is progressing satisfactorily. The water in the shaft has been lowered to within 12 ft. of the bottom level. The pumps are handling about 19,000 gal. per minute, which reduces the water about 6 in. per twenty-four hours.

Hibbing—The Rogers Brown Iron Mining Co. has stopped sinking its new shaft, which work was in preparation for new underground development.

Cuyuna Range

Armour No. 2 and Hillcrest Only Shippers in June—Pumps Pulled at Cuyuna-Mille Lacs

Ironton—The Armour No. 2 mine (Inland Steel Co.) and the Hillcrest mine (Coates & Tweed) were the only two Cuyuna Range properties that shipped ore in June. The former is working one shift with reduced force and shipping from pockets about 350 tons per day; the latter, an open pit mine, is shipping an average of 1,000 tons per day of iron ore and manganiferous iron ore. The Hillcrest will ship 100,000 tons for the season. No other properties are producing ore.

Pumps have been pulled at the Cuyuna-Mille Lacs mine, a manganiferous iron ore property formerly operated by the Cuyuna-Mille Lacs Iron Co., a subsidiary of the American Manganese Manufacturing Co. The mine has been idle since spring, 1919, but pumping was continued in anticipation of an upward trend in manganese ore market. Mine pumps handled 1,600 gallons per minute, making heavy pumping cost. The mine was recently examined by O. W. Wheelwright, William Kelly and G. A. Jahn representing Eastern steel interests.

The Pennington mine has recently shipped one of its steam shovels to the Mesabi Range for Todd-Stambaugh Co. The Pennington has done no mining so far this season.

Riverton—John A. Savage & Co. is erecting a modern engine-repair shops of concrete and steel at its Sagamore mine. This company has waived shipments on a 100,000-ton contract this season, but is continuing to strip further ore reserves with hydraulic equipment. In the course of this stripping fifteen complete skeletons of buffalo buried at a depth of 8 to 12 ft. have been found in the muskeg overburden.

Crosby—Changes in the personnel of the Rogers-Brown Ore company have recently been announced. C. A. Stillman, formerly president of the company, goes to the Goodyear Tire & Rubber Co., Akron, as secretary: while H. J. Schlesinger, of the Steel & Tube Co. of America, will succeed Mr. Stillman. A. D. Chisholm, superintendent of the Newport mine at Ironwood, Mich., has been elected a vice-president of the Rogers Brown Ore Co., and will have general supervision over the Cuyuna Range operations. The Steel & Tube Co. owns 51 per cent of the stock of the Rogers Brown Ore Co., which operates two mines here, the Meacham and the Kennedy. The Meacham is carrying on only development work this season. The Kennedy continues to operate four shifts per week, has 90 000 tons of ore in stockpile but has made no shipments.

Trommald—The Marquette Ore Co., operators of the Maroco mine, report the sale of a large tonnage of Maroco ore. Orders have been received for pushing the work at the mine to the utmost and the property is expected to ship to capacity during the last three months of the season. The pit approach, started with hydraulic and sand sucker, is being completed to grade by a steam shovel, which will then make a clean-up of overburden averaging 10 ft. deep. Operators will materially increase labor forces Aug. 1, at which time they expect to be ready to dig ore. Stripping is being continued by hydraulic method eastward from the present pit, cutting ground formerly occupied by the main line of the Northern Pacific. A large portion of this orebody is of wash ore type, but it is planned to make this year's shipments, so far as possible, from direct shipping ore, leaving the initial run of ore through the washing plant until the 1922 season.

Riverton — The Sagamore mine is stripping by hydraulic methods an average of 50,000 cu.yd. per month. Ore uncovered during the last three months on the north bank of the pit is now being checked by Keystone churn drilling for next season's operations. Stripping is being continued along the south bank. Ore pit is being kept drained by a Glendora triple-plunger type pump, motor-driven, handling 900 gal. per minute from the drainage shaft.

A call for 200,000 tons of Kennedy mine ore is reported during the last week. This order comes at a time when closing of the mine was being seriously considered. The Kennedy, operated by Rogers-Brown Ore Co., has been working four days a week with alternating crews during the present season, and now has approximately 100,000 tons of ore in stock.

NORTH CAROLINA

Operations Resumed at Alred Gold Mine—Working at Ormond Property

Randolph County—The Alred mine is again being operated after having been down some time for alterations in the mill. Twenty of the thirty stamps are dropping one shift. Pulp from ten stamps is passed over amalgamation plates and then blanketed. That from the other ten stamps is passed over plates followed by a Plat-o table lately installed and giving satisfactory result, with a fairly high-grade concentrate. Two more Plat-o tables are to be installed. The orebody is 50 ft. wide here and is being developed by an open cut which supplies the mill. The ore is mineralized schist and in depth will be pyritic. The present oxidized ore exhibits numerous cubes of limonite, altered from pyrite. These contain gold and the centers are partly unaltered pyrite that furnish the concentrate. Another narrower orebody parallel to the large one has also been developed, which contains more free gold.

Montgomery County—D. C. Stainbach is doing some work at the Ormond property. The prospect is not a typical southern one, and its development is being watched with interest. The country rock is either rhyolite or metamorphosed sandstone, containing some gold, but the real ore is a high-grade soft streak lying along a well defined fissure.

WEST VIRGINIA

Bluefield—R. B. Miller, of Bluefield, states that in examining a manganese property some months ago on the Southern R.R. between Lynchburg, Va., and Durham, N. C., he discovered cobalt and nickel ore. Erythrite was found in the outcrop. Six feet from surface samples were taken running 48 per cent cobalt oxide with traces of iron. Two other samples showed 34 per cent Co and 18 per cent Ni also 16 per cent Ni and 28 per cent Co.

WISCONSIN

Platteville—The 200-ton mill moved from the Climax by Kistler & Stephens is being assembled on the Goke lease which has been proved by drill and shaft. It is a quarter-mile east of the company's Blockhouse mine.

WYOMING

Centennial—The Colowyo Gold Mining Co., of Centennial, Wyo., has applied to the Federal Power Commission for a preliminary permit to construct a power house on the Middle Fork of the Laramie River in Albany County, Wyo., to develop 100 hp. to be used for mining purposes.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
7	12.375–12.50	28 00	28 875	4.40@4 50	4 30@4 35	4 30@4 35
8	12.375–12.50	28 00	28 875	4 45@4 50	4 30@4 35	4 30@4 35
9	12.375–12.50	27 50	28 375	4 45@4 50	4 30@4 35	4 30@4 35
11	12.375–12.50	27 50	28 25	4.45@4 50	4.30@4.35	4.30
12	12.375–12.50	27 375	28 25	4 45@4 50	4 30@4 35	4 30
13	12.375–12.50	27 375	28 25	4 45@4 50	4 30@4 35	4 25@4.30

*These prices correspond to the following quotations for copper, "delivered": 12.625@12.75c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
7	72⅜	72¾	75½	168½	170½	23⅜	23¼	26¾	27⅜
8	72¾	72⅝	75½	168⅝	170⅜	23⅛	23	26⅝	27⅛
9									
11	72½	72⅝	76½	166	168½	23⅛	23	26¾	27⅛
12	72	72⅛	76½	166½	168¼	23⅛	23	26¾	27⅛
13	72⅛	72¼	76½	166¾	169	23⅛	23	26⅜	27⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange	Silver			July	Sterling Exchange	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
7	370½	99¼	59½	36½	11	362¼	99½	59¼	36⅞
8	3 0½	99¼	60	36⅜	12	363	99¼	59½	37
9	367	99¼	61	37½	13	363¾	99¼	60½	37¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, July 13, 1921

Lead, zinc, and copper, in the order named, have been in better demand during the last week, and producers have a somewhat more optimistic feeling. It is generally believed, however, that any general revival of business is a long time in the future, and that no large demand for metals is likely during the next few months. Transatlantic freight rates are now $11 to England, $9 to Germany, and $8 to France. Transpacific rates to Hongkong and Kobe, $10.

Copper

A few domestic inquiries were in evidence on Thursday and Friday, but no business of importance developed. The large buyers continue to show no interest in the market except to assure themselves that no sudden advances are developing. For July and August, 12.75c., delivered, could be done in almost any quarter, and some of the more anxious sellers among the small producers and traders have booked small orders at 12.625c. for prompt delivery. More interest is being shown in deliveries for the last quarter, and although most producers will not consider bids for later than September, it is likely that one would find copper available for any month in the year for not more than 13c.

The Copper Export Association has done a fair business with Japan and Germany. Outside interests in the export market have quoted prices as low as 13.375@13.50c. f.a.s. New York, to compete with the association on European business. English dealers are also offering sharp competition. On Monday, the largest cable manufacturer in England bought in that country for £77, equivalent to 12.45c. c.i.f. at the then current rate of exchange. The increased premium on the American dollar has, of course, aided English dealers in business of this kind.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.40c.

Demand for lead has been very satisfactory indeed during the last week, and almost all producers have made sales. Sellers seemed willing to supply all consumers without advancing their price levels to any extent. We have been unable to verify reports of lead sold on a higher basis than 4.50c., New York, and at least one producer quoted at this figure or less on every inquiry received. There is some disposition to quote slight premiums on forward business, but practically the entire demand is for July or August at the latest. Most of the business has been in the East, storage battery, cable, and cartridge manufacturers being the best customers. The demand for cartridges for sporting purposes is reported excellent this summer. Lead continues to be in the strongest position of all of the metals, and demand is exceedingly satisfactory in the face of the general industrial depression.

Zinc

Although some of the larger producers have withdrawn from the market, sales were heavier than for many weeks. Supplies of zinc were plentiful at prevailing low prices, so that no advance occurred. The market is established nowadays by an exceptionally small volume of trade. Consumption is at the lowest ebb known, according to some operators, who also characterize the present situation as being due mainly to the efforts of "weak sisters" in the zinc-mining business, who, being financially pressed, must cash in their stocks. Despite the small present zinc production of the United States, estimated between 18,000 and 19,000 tons per month, stocks have shown a steady increase since the first of the year and are now about 15 per cent larger than on Jan. 1. The hope is held in some parts that the steel business may pick up in August, which should, in turn, improve the zinc trade.

High-grade zinc is reported unchanged at 6.25c., with the freight allowance to Eastern points.

Tin

Demand continues almost non-existent, with decreasing prices owing to the drop in sterling exchange. As in other metals, the price has little to do with sales, consumers being willing to take chances on getting their raw materials at a reasonable figure when the market for manufactured products opens up. There was quite a flurry in tin on Monday, but it was confined almost entirely to irresponsible trading interests. Futures continue to be quoted at the same prices which obtain for spot.

Arrivals of tin, in long tons: July 2, Singapore, 15; 5th, Rotterdam, 75; Liverpool, 25; 6th, London, 25; 7th, London, 75.

Gold

Gold in London: July 7th, 110s. 9d.; 8th, 110s. 10d.; 11th, 112s. 10d.; 12th, 113s. 4d.; 13th, 112s. 9d. The flood of gold to the United States continues unabated.

Foreign Exchange

Saturday and Monday, sterling experienced a severe decline, and the tendency in all of the important exchanges is decidedly uncertain. Variations in values are likely to be quick and wide. On Tuesday, July 12, francs were 7.86c.; lire, 4.61c.; and marks, 1.3575c. New York funds in Montreal, 14¼ per cent premium.

Silver

During the last week the London market has fluctuated widely, with a low of 36¼d. on July 7, and a high of 37⅜d. on July 13. Buying by the Indian bazaars and China has caused the advances in price, and sales of Continental silver caused the reactions. The New York market also has been erratic, due to the changes in the London quotation and the weakness of sterling exchange. On the strength of China buying, local rates, however, have ruled somewhat higher than the London parity.

Mexican Dollars, July 7th, 45⅝; 8th, 46⅛; 9th, 46⅞; 11th, 45⅝; 12th, 45⅝; 13th, 46⅛.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4⅞c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot, 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$60@$65 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $45@$47 per 75-lb. flask. San Francisco wires $47.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55. Prices have been reduced $1 per ton for the 1921 season.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports. Nominal.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., July 9—Zinc blende, per ton, high, $24.40; basis 60 per cent zinc, premium, $22; Prime Western, $21; fines, $20; slimes, no sale; average settling price, all grades of zinc, $22.50.

Lead, high, $52.70; basis 80 per cent lead, $45; average settling price, all grades of lead, $42.96 per ton.

Shipments for the week: Blende, 3,874; lead, 667 tons. Value, all ores the week, $113,680.

Two smelters that have been out of the market again bought ore this week, but sellers still withheld ore from the market, and the purchase aggregated only 2,720 tons. Production continues above 5,000 tons per week, and with this week's shipment only 3,874 tons, an increasing tonnage of reserve stock is indicated.

Platteville, Wis., July 9—No market for zinc or lead ores. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead, 978 tons. Shipped during the week to separating plants, 160 tons.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga. Prices largely nominal.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $20@$25, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—Crude, $7@$8 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$8.50, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine. No. 1 Canadian, $26@$28, f.o.b. cars. Market quiet; prices largely nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $18 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, ¾@2½c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica. slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

[1]Foote Mineral Co., Philadelphia, Pa.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $16@$18 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $28@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$42; 50 per cent, $68@$72; 75 per cent, $135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.50@$5 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21½c. per lb.; wire, 15@15½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16¾c.; sheathing, 16½c.; rods, ⅝ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, July 12, 1921

Another downward revision in steel prices has occurred in the last few days, with the general announcement of a new schedule. In most commodities the reduced prices had already been quoted, though not by all producers, and particularly not by the Steel Corporation. In plates the new asking price of 2c. is higher than the price in many if not most sales in the open market for two or three weeks. In standard steel pipe, on the other hand, the price as now reduced had been altogether exceptional, if made at all, and in nails the shading had hardly been equal to the reduction now made.

The reductions are $4 a ton in bars, shapes, plates, billets, slabs and sheet bars from the so-called "April prices" and $5 a ton in sheets and wire products from quotations as reduced meanwhile by $5 a ton from the April prices, so that these commodities record a $10 reduction. The new prices on finished-steel products average about $12 a net ton below the Industrial Board prices and about $23 below the war-control prices, though they are about $18 above the average prices in 1913.

Pig Iron—Bessemer is quotable at $21.50, Valley, or $1 decline, basic and foundry remaining at $20 and $21 respectively, with demand extremely light.

Coke

Connellsville — Furnace, $2.75@$3: foundry, $4@$4.50.

Germany's Important Support to the Copper Market

Export Trade Is the Chief Factor in the Prosperity of Copper Producers—Germany in Pre-War Role of Heaviest Foreign Copper Purchaser—Production Now Practically at Its Ebb

EDITORIAL MARKET STUDY

QUIETNESS AND ACTIVITY in the copper market are co-existent. Domestic business is nothing to shout about, and were it not for the fact that export demand has borne up surprisingly well, the American copper producer would indeed find small satisfaction in the behavior of copper during the first half of 1921. Export trade has been the bright spot in the copper market, and it has been so nourished and stimulated by low quotations, credits, and financial aids that the copper movement to Europe has assumed, at times, favorable proportions. Occasionally the volume of copper exports has been so heavy that a producer could neglect the domestic market, his share of copper exports under the provision of the Copper Export Association plans being sufficient to make up for the deficiency in domestic business.

The table of copper movements shown below indicates that monthly copper exports for the first five months of 1921 were from 55 to 92 per cent of the pre-war rate. The three most important purchasing countries were England, France, and Germany. Exports to each of these nations are given monthly, and bring out the highly significant fact that Germany has lately been the chief support to copper export trade. This statement is all the more remarkable when it is recalled that Germany pays cash for copper purchased in the United States, whereas France, England, and other countries have been and are able to take advantage of the liberal credit terms advanced by the Copper Export Association.

The omission of Germany from the list of those countries with which credit arrangements can be consummated has not had much effect on the ability of Germany to purchase all the copper she wishes. It may be, now peace has been officially declared, that negotiations will be entered into, looking to the extension of credit to Germany as to other countries. Whether such a step would increase sales to Central Europe is problematical. At the same time that Germany is purchasing copper from United States producers, she is also supporting the London copper market. The source of the credit for all these purchases is not definitely known, and the extraordinary ability of a nation defeated in war, burdened with an enormous indemnity, yet ready to pay cash for its raw-material purchases, is testimony to the fact that she still has friends willing to aid her financially.

The copper furnished Germany will not enter a war chest, as was the charge prior to the war, but will undoubtedly be cheaply manufactured into electrical machinery to be exported to all parts of the world. Copper, cotton, wool, and other raw commodities are urgently required by Germany to furnish the basis of her exportable manufactures, which in turn are her hope of discharging the reparation obligations.

The market outlook in the United States, although by no means rosy, no longer has the bleak appearance of the latter part of 1920. Those two most important steps, the financing of 400,000,000 lb. of surplus copper, and the sharp curtailment of production, have placed producers in a position from which they can view the future with confidence. Regardless of how small present world's consumption may be, United States production has fallen to a level smaller than monthly exports. The relation of present smelter production to pre-war, war, and post-war production is shown in the following table:

SMELTER PRODUCTION OF UNITED STATES COPPER

Year:	Average Monthly Output in Pounds
1910–1913	96,700,000
1916 (Peak)	162,000,000
1919	100,800,000
1920	114,300,000
Jan., 1921	90,600,000
Feb., 1921	86,600,000
March, 1921	91,000,000
April, 1921	47,000,000
May, 1921	25,300,000

Since March, smelter production has declined rapidly, and for May it is about one-quarter of the pre-war rate of production. Copper output is now about as low as it will get, unless the industry receives further blows. The most important companies producing copper at present can be counted on one's fingers—Miami, Kennecott, American Smelting & Refining Co. (custom business), Copper Range, Quincy, Tennessee Copper, New Cornelia, and East Butte. Of course some American copper companies operating in foreign countries have not shut down, i.e. Cerro de Pasco, Chile, and Granby, and their production swells copper imports into the United States. Even with the addition of such importations, export trade alone, should it continue at the rate indicated in the first five months of the year, will be more than sufficient to take care of domestic production plus imports.

An echo of the serious condition of the copper industry of the United States is reflected in reports reaching this country of conditions in Australia, a great metal-producing continent, where copper production has been drastically cut and where the cost of copper production is prohibitive of further operation. The gravity of the Australian situation is, in large measure, due to difficulties with labor and the unwillingness of labor to accept a reduction in wages. Mount Morgan and Mount Lyell, two of the largest base-metal-smelting concerns, have announced their inability to continue operating under present conditions. Other properties have already closed down or are on the verge of doing so.

Comments from the London press frequently allude to the activity of the Copper Export Association and have intimated that the organization is threatened with disruption. If such a fate really hangs over that body, it is news to the American copper industry, as the association has been functioning entirely satisfactorily and is, from all reports, in a splendid financial condition.

Recovery in the copper market, long awaited by producers, is not expected during the summer and depends upon so many factors closely linked with general industrial prosperity that it is idle to hazard any guess as to when resumption of operations will occur.

COPPER MOVEMENTS TO AND FROM THE UNITED STATES

In Pounds

	Average Monthly Pre-war	Average Monthly 1920	Jan., 1921	Feb., 1921	March, 1921	April, 1921	May, 1921
EXPORTS							
United Kingdom	5,583,000	8,290,000	8,668,000	18,970,100	7,407,000	7,976,600	6,765,000
France	11,530,000	9,874,000	15,012,000	10,243,000	2,926,000	10,800,000	4,455,000
Germany	18,366,000	7,432,000	18,802,000	20,725,000	19,021,000	15,838,000	7,074,000
Total (all countries)	67,266,000	51,068,000	54,855,399	62,480,000	38,720,000	41,495,000	35,378,000
IMPORTS							
Total (all countries)	28,350,000	30,770,000	31,136,000	30,056,000	12,808,000	29,569,000	12,689,000

COMPANY REPORTS

Braden Copper Income $756,764

A report of operations of the Braden Copper Mines Co. for 1920 states that 32,459 tons of blister copper was produced, compared with 21,020 in 1919. Income account follows:

Operating revenue		
Copper sold and delivered, 56,491,144 lb. @ 18.375c.		$10,379,981.99
Gold and silver		66,568.98
		$10,446,550.97
Operating cost		
Plant cost	$6,725,063.08	
Freight to seaboard	241,593.27	
Embarking	47,981.51	
Ocean freight	549,675.02	
Insurance	65,067.92	
Refining	445,655.52	
Delivery and selling expenses	279,256.67	8,354,292.99
Operating profit		$2,092,257.98
Other income		
Dividends—Sherman Steamship Co.	$300,000.00	
Miscellaneous income	27,245.98	327,245.98
Total income		$2,419,503.96
Charges against income		
Taxes and interest		1,662,740.44
Balance of income carried to surplus account		$756,763.52
Surplus account		
Net balance, Dec. 31, 1919, as adjusted		5,519,650.73
Income for year, as above		756,763.52
		$6,276,414.25
Charges against surplus		
Depletion of ore reserves	$1,275,570.03	
Depreciation of construction and equipment	1,540,833.72	
Loss on plant and equipment superseded or abandoned	142,213.87	
Amortization of discount on bonds	128,461.56	
	$3,087,079.18	
Less: Discount on bonds purchased for retirement	150,378.70	2,936,700.48
Balance Dec. 31, 1920		$3,339,713.77
Less balance of unamortized discounton bonds		1,284,615.34
Net earned surplus, Dec. 31, 1920		$2,055,098.43

The company is a subsidiary of Kennecott Copper Corporation. Capitalization, $12,953,530; bonds issued, fifteen year, 6 per cent sinking-fund gold bonds, $15,000,000.

Chile Copper's Deficit Increases

A statement of operations of the Chile Exploration Co. for the first quarter of the year 1921 states that 581,644 tons of ore was treated, averaging 1.64 per cent copper. In the preceding quarter, 1,066,899 tons, averaging 1.59 per cent copper, was treated. Despite reduced tonnage, the cost of copper produced during the quarter was 11.012c. per lb., including selling and delivery expense.

The financial statement of the Chile Copper Co. and Chile Exploration Co. combined (earnings being based on copper actually delivered), as compared with the preceding quarter, is as follows:

	First Quarter, 1921	Fourth Quarter 1920
Pounds copper delivered	15,070,157	18,348,922
Net profit on copper delivered	$283,768.18	$568,651.89
Miscellaneous income	24,691.75	(*a*) 95,652.38
Interest on call loans and bank balances	181,845.99	196,427.46
Total income	$490,305.92	$669,426.97
Depreciation	$696,058.99	$419,612.65
Amortized discount on 15-year 6% convertible bonds	35,000.00	35,000.00
Accrued bond interest of Chile Copper Co.	787,500.00	796,162.02
Expenses of Chile Copper Co.	8,035.44	15,132.85
Total charges	$1,526,594.43	$1,265,907.52
Balance undivided profits for quarter, both companies	(*a*) $1,036,288.51	(*a*) $596,480.55

(*a*) Loss.

Of the apparent loss of $1,036,288.51, the sum of $696,058.99 is for depreciation, which is a book entry and is computed on a time basis.

Lucky Tiger-Combination Gold Mining Co.

Gold, Silver; Sonora, Mexico

A report of operations of the Lucky Tiger-Combination Gold Mining Co. for 1920 states that 6,746 tons of concentrate, assaying 2.78 oz. gold, 433.31 oz. silver, 3.9 per cent copper and 14.05 per cent lead, was produced in the period covered by the report, yielding a revenue of $3,405,489.96. Operating statement follows:

Gross value of ore sent to the stamp mill, at average quotations for the year, was	$3,550,979.66
Total costs and losses, including residues and tailings amounted to	2,015,501.00
Leaving an operating profit of	$1,535,478.66
Deducting provision for U. S. expense, taxes, sundry profits, depreciation and depletion, amounting to	743,276.90
Leaves a net profit of	$792,201.76
The above costs were distributed as follows:	
Development	$194,694.02
Mining	341,267.69
Milling	285,768.71
General	109,979.23
Marketing	571,886.64
Production tax	366,415.01
	$1,870,011.30
Loss in residues	145,489.70
Total costs and losses	$2,015,501.00

Dividends paid during the year totaled $1,323,373.45, or $1.85 per share. Capitalization, $7,153,370.

Le Roi No. 2, Ltd., Losses, £12,181

Copper; British Columbia

A report of operations of Le Roi No. 2, Ltd., (British) for the fifteen months ending Dec. 31, 1920, states that 16,422 tons of ore was shipped, valued at $271,743, or $16.55 per ton, and composed as follows: 0.6203 oz. gold, 0.712 oz. silver, 17.5627 lb. copper. Smelting charges were $7.4367 per ton. Profit and loss account follows:

	£	s.	d.
Dr. ore production:			
Mining, including office expenses, and general expenditure in Rossland	34,346	11	9
Concentration account			
Insurance	115	9	1
Interest	100	12	4
London expenditure			
General expenses	135 14 6		
Directors' fees	1,375 0 0		
Salaries	91 4 9		
Secretarial, rent and clerical services	329 17 6	1,931	16 9
Income tax		345	0 0
Audit fees, London		39	7 6
Total		£36,888	17 5

	£	s.	d.
Cr. ore account	23,392	19	8
Miscellaneous receipts	29	1	10
Interest and dividends on investments	1,268	7	11
Transfer and other fees	17	7	6
Balance	12,181	0	6
Total	£36,888	17	5

Profit and loss account balance, Sept. 30, 1919, was £21,087 12s. 6d. Adding net recovery of income tax, £669 10s. 10d., and deducting a dividend of £6,000 and the loss for the period of £12,181 0s. 6d., leaves a balance of £3,576 2s. 8d. Capitalization, 120,000 shares of £5 each, issued and fully paid.

Buena Tierra Mining Co., Ltd.

A report of operations of the Buena Tierra Mining Co., Ltd., for 1921 shows an excess expenditure over receipts of £34,619 9s. 11d., which, added to the debit balance brought forward, £4,727 4s. 3d., makes a total deficiency of £39,346 14s. 2d. During the year 6,927 tons of ore was shipped, averaging 8.6 oz. of silver and 9.69 per cent lead, the net smelter return being £63,048.

MINING STOCKS

Week Ended July 9, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	50	47½	50	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*42	*38	*40		
Allouez	Boston	....	....	20	Mar. '19	1.00
Anaconda	New York	39	37⅛	38⅛	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2 1/16	2 1/16	2 1/16		
Ariz. Com'l	Boston	8¼	8	8¼	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*20	*13	*19		
Bingham Mines	Boston	9	9	9	Sept. '19, Q	.25
Calumet & Arizona	Boston	49	46	46	June '21, Q	.50
Calumet & Hecla	Boston	227	222	225	June '20, Q	5.00
Canada Copper	N. Y. Curb	*31	*25	*26		
Centennial	Boston	8¼	7⅞	8¼	Dec. '18, SA	1.00
Cerro de Pasco	New York	27	25½	26	Mar. '21, Q	.50
Chile Copper	New York	10⅞	10⅛	10⅜		
Chino	New York	24⅛	22⅞	24	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	....	....	*26		
Con. Arizona	N. Y. Curb	*3	*3	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅛	1⅛	1 1/16		
Copper Range	Boston	33½	32	33	Sept, '20, Q	.50
Crystal Copper	Boston Curb	*35	*32	*35		
Davis-Daly	Boston	6	5⅞	6	Mar. '20, Q	.25
East Butte	Boston	8	7⅛	8	Dec. '19, A	.50
First National	Boston Curb	*52	*52	*52	Feb. '19, SA	.15
Franklin	Boston	2⅛	1⅛	1⅛		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	....	....	20	May '19, Q	1.25
Greene-Cananea	New York	21⅛	20½	21⅛	Nov. '20, Q	.50
Hancock	Boston	....	....	3½		
Howe Sound	N. Y. Curb	2⅛	2	2⅛	Jan. '21, Q	.05
Inspiration Consol.	New York	34	32⅛	34	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....	....	5	Sept. '20, K	.25
Isle Royale	Boston	20⅛	19	20⅛	Sept. '19, SA	.50
Kennecott	New York	20½	18⅛	20	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1½		
Lake Copper	Boston	....	....	2⅛		
La Salle	Boston	1⅛	1⅛	1⅛		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	18⅛	18	18⅛	Jan. '19, Q	.50
Majestic	Boston Curb	9	9	9		
Mason Valley	Boston	1½	1½	1½		
Mass Consolidated	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	3⅛	3⅛		
Miami Copper	New York	22⅛	21	21⅛	May '21, Q	.50
Michigan	Boston	....	....	2		
Mohawk	Boston	49	47⅛	48⅛	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅛	5⅛	5⅛		
Nevada Consol	New York	11½	11	11	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14½	14¼	14⅛	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	9⅛	9	9⅛	Oct. '18, Q	.25
North Lake	Boston	....	....	⅞		
Ohio Copper	N. Y. Curb	8	6	....		
Old Dominion	Boston	25	21⅛	23⅛	Dec. '18, Q	1.00
Osceola	Boston	27	26⅛	26⅛	June '20, Q	.50
Phelps Dodge	Open Mar.	†150	†145	....	July '21, Q	1.00
Quincy	Boston	37	37	37	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅛	12⅛	12⅜	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*24		
St. Mary's Min. Ld.	Boston	33⅛	33⅛	33⅛	June '20, K	2.00
Seneca Copper	Boston	....	....	14		
Shannon	Boston	....	....	*80	Nov. '17, Q	.25
Shattuck Arizona	New York	6⅛	6⅛	6⅛	Jan. '20, Q	.25
South Lake	Boston	....	....	1		
Superior Copper	Boston	3⅛	3⅛	3⅛	Apr. '17,	1.00
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs	New York	8	7⅛	7⅛	May '18, I	1.00
Toulumne	Boston	*60	*55	*55	May '13,	.10
United Verde Ex.	Boston Curb	25	24	24⅛	May '21, Q	.25
Utah Consol	Boston	4	3⅛	3⅛	Sept. '18,	.25
Utah Copper	New York	51⅛	48⅛	50	June '21, Q	.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec. '17,	.30
Victoria	Boston	....	....	1⅛		
Winona	Boston	*50	*50	*50		
Wolverine	Boston	10	8½	10		
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	13⅛	13⅞	Mar. '19,	.50
Internat. Nickel, pf.	New York	....	....	82⅛	May '21, Q	1.50
LEAD						
National Lead	New York	76	74⅛	76	June '21, Q	1.50
National Lead, pfd.	New York	....	....	100	June '21, Q	1.75
St. Joseph Lead	New York	....	....	12	June '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50	....	*50		
ZINC						
Am. Z. L. & S	New York	8⅛	8⅛	8⅛	May '20,	1.00
Am. Z. L. & S, pfd.	New York	....	....	24	Nov. '20, Q	1.50
Butte C. & Z	New York	4⅛	4⅛	4⅛	June '18,	.50
Butte & Superior	New York	14⅛	12⅛	13	Sept. '20,	1.25
Callahan Zn-Ld	New York	4⅛	4⅛	4⅛	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	111	111	111	May '21, Q	2.00
Success	N. Y. Curb	....	....	*2⅛	July '16,	.03
Yellow Pine	Los Angeles	....	....	*55	Sept. '20, Q	.03
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Carson Hill	N. Y. Curb	....	....	13⅛		
Cresson Consol. G.	N. Y. Curb	1⅛	1⅛	1⅛	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	17⅛	17	17⅛	Apr. '21, Q	.25
Florence Goldfield	N.Y. Curb	*27	*27	*27		
Golden Cycle	Colo. Springs	....	....	*70	June '21, Q	.02
Goldfield Consol	N. Y. Curb	*7	*6	*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7.12	7.10	7.12	June '21, M	.05
Homestake Mining	New York	55	55	55	June '21, M	.25
Kirkland Lake	Toronto	....	....	*38		
Lake Shore	Toronto	1.18	1.16	1.16	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.88	1.86	1.88	May '21, K	.05
Porcupine Crown	Toronto	*13⅛	*13	*13	July '17,	.03
Portland	Colo. Springs	*52	*52	*52	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Silver Pick	N. Y. Curb	*20	*20	*20		
Teck Hughes	Toronto	*11½	*11½	*11½		
Tom Reed	Los Angeles	*71	*65	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅛	2 1/16	2 1/16	Apr. '21, Q	.15
Vindicator Consol	Colo. Springs	....	....	*32⅛	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6	*5⅛	*5⅛		
White Caps Mining	N. Y. Curb	*8	*6	*6		
Yukon Gold	N. Y. Curb	*98	*90	*97	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*23	*19	*20	Apr. '20, M	.03
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	.12½
Beaver Consol	Toronto	*29	*29	*29	May '20, K	.03
Coniagas	Toronto	....	....	1.75	May '21, Q	.12½
Crown Reserve	Toronto	*8	*7⅛	*7⅛	Jan. '17,	.05
Kerr Lake	Boston	3	2⅞	3	Apr. '21, Q	.12½
La Rose	Toronto	....	....	*20	Apr. '18,	.02
McKinley-Dar.-Sav	Toronto	*18	*18	*18	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.05	1.05	1.05	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅛	4	4	Apr. '21, Q	.15
Ontario Silver	New York	....	....	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*17	*16	*16	Jan. '12,	.10
Peterson Lake	Toronto	*4⅛	*4⅛	*4⅛	Jan. '17,	.01½
Temiskaming	Toronto	*20½	*20	*20	Jan. '20, K	.04
Trethewey	Toronto	*12½	*12	*12	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte	....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*54	*45	*52		
Cash Boy	N. Y. Curb	*5	*4	*5		
Consol. Virginia	N. Y. Curb	*25	*25	*25		
Dolores Esperanza	N. Y. Curb	2⅛	2⅛	2⅛		
El Salvador	N. Y. Curb	*15	*12	*14		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	....	....	*4	June '16,	.05
Louisiana Con	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*17	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10⅛	19	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	*98	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*85	*72	*82		
Tonopah-Extension	N. Y. Curb	1 1/16	1⅛	1 1/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1 1/16	1½	Apr. '21, SA	.05
West End Consol	N. Y. Curb	*84	*78	*81	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*10	*9	*9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	....	....	1.07½	Dec. '21,	.15
Chief Consol	Boston Curb	2⅛	2⅛	2⅛	May '21, Q	.05
Consol. M. & S	Montreal	14	14	14	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2½	....	....	July '20, Q	.10
Daly-West	Boston	3	3	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2½	†2	2	Apr. '21, K	.05
Electric Point	Spokane	....	....	*7	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*32	*29	*32		
Federal M. & S	New York	....	....	7	Jan. '09,	1.50
Federal M. & S., pfd	New York	24	24	24	June '21, Q	1.00
Florence Silver	Spokane	....	....	*12½	Apr. '19,	.01½
Grand Central	Salt Lake	†*40	....	....	June '20, K	.03
Hecla Mining	N. Y. Curb	3⅛	3⅛	3⅛	June '21, Q	.08
Iron Blossom	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S	Salt Lake	†2.95	....	....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*5	*5	*5	June '21, I	.02
Prince Consol	N. Y. Curb	*26	*26	*26	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4½	*4	*4	Feb. '19,	.01
Rex Consol	N. Y. Curb	*8	*7	*8		
South Hecla	Salt Lake	*35	*34⅛	*35	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*15	*12	*13	Oct. '17,	.05
Stewart Mining	Boston Curb	....	....	*6	Dec. '15	.05
Tamarack-Custer	Spokane	1.80	1.75	1.75	Jan. '21 K	.04
Tintic Standard	Salt Lake	....	....	2.27½	July '21, Q	.05
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*3	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	31⅛	28	29⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp	Montreal	....	....	46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	....	....	75	Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref	New York	39	36⅛	37⅞	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	....	....	68⅛	June '21, Q	1.75
Am. Sm. pf. A	New York	67⅛	67⅛	67⅛	July '21, Q	1.50
U. S. Sm. R. & M	New York	30⅛	30⅛	30⅛	Jan. '21, Q	.50
U.S.Sm.R.& M. pf	Boston	39¼	39¼	39¼	Apr. '21, Q	.87½

* Cents per share. † Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annualy. BM, Bi-monthly. K, Irregular I, Initial. X, Includes extra.